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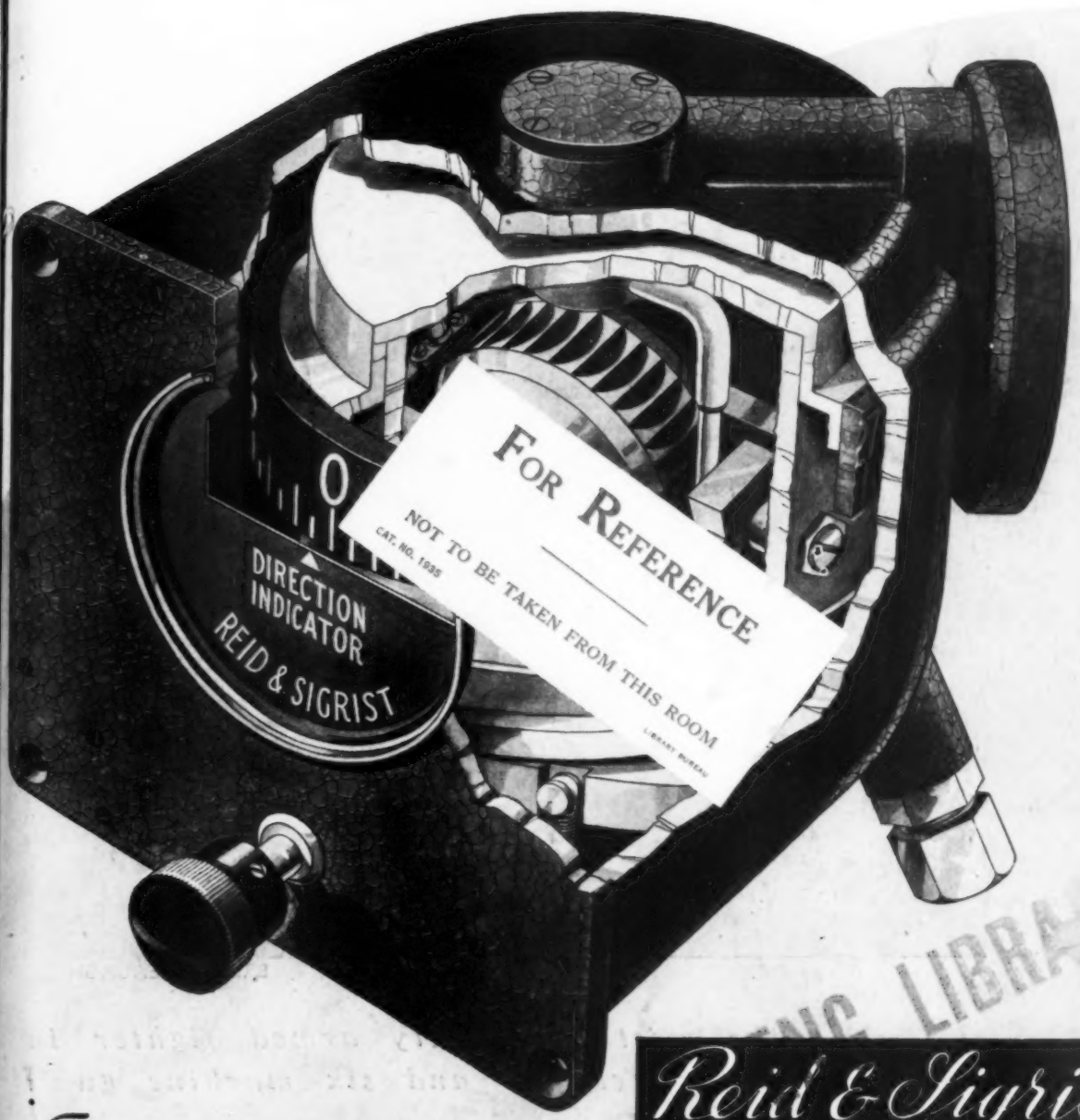
FLIGHT

and The AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

DECEMBER 16th, 1943



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FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

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The Outlook

Close Air Support

THE *Luftwaffe* has for some time past been doing next to nothing in Italy, and, in fact, its strength there has been reduced considerably since the beginning of the year. The North-West African Air Forces have had things all their own way, and yet the progress made by the troops of General Alexander has been slow. These facts have led a writer in a contemporary to suggest that the close support given to troops by British and American aircraft must be less efficient than that given by the *Luftwaffe*.

Such a theory displays an ignorance of the conditions of air power as a weapon of an army. The German methods were successful in Poland, in Norway, and in the Battle of France. Perhaps one might add in the Greek campaign, too, though the German superiority in ground troops there makes the case less striking. Crete was an isolated case, hardly likely to be repeated. On the whole, one would not be far wrong in saying that the last clear-cut case of the success of German methods was the Battle of France.

The main feature of these German successes was the use of the Stuka in combination with fast-moving mechanised ground columns, and it owed a good deal of its success to its novelty; it came as a surprise. The Stuka has lately reappeared over the Dodecanese islands, but it has vanished from major campaigns.

The reasons why Allied progress in Italy has been slow, despite the possession of air superiority, have really nothing to do with German methods in Poland and France. In Tunisia the air support given to the Allied Armies was very effective, but at the end of that campaign Air Marshal Coningham uttered a warning that similar results could not be expected in the weather of Europe. The Germans evidently came to the same conclusion, as they decided to withdraw squadrons from Italy.

Apart from the weather, one is bound to come to false conclusions if one forgets for a moment that in Italy the fighting has mostly been in the Appenines, and that in mountains army bombers are less effective than they are in any other sort of terrain. Usually, a near-miss is practically innocuous; only a bullseye is of any effect. The Germans evidently knew that their men could make a stout stand in the mountains without any help from the *Luftwaffe*, and so it has proved. But, given suitable conditions, Air Marshal Coningham's Tactical Air Force has shown that it can give close support to an army in ways which make the German methods in Poland read like ancient history.

Allied Air Supremacy

THE significance of the statement made recently in Canada by Mr. C. G. Power, Minister of National Defence for Air, concerning changes in the training programme can scarcely be overrated. Due, he said, to the ascendancy of the Allied air forces over the *Luftwaffe*, the wastage rate in other than Bomber Command had been much lower than that estimated when the Empire Training Scheme was based on no such ascendancy. Consequently, there had been accumulated a surplus of air crews in Fighter Command, and in future the Air Training Plan would give attention to the more intensive development of requirements for bomber crews.

Mr. Power said that, while heavy fighting was expected next year, it was felt that, except for Bomber Command, it could be assumed that wastage would not again rise to

the level calculated when the Germans held the initiative and deployed superior forces against us. *There was no evidence,* Mr. Power said, *that the enemy had a hidden reserve to contest the supremacy which the Allies now possessed.*

That statement must be as distressing to the enemy as it is heartening to the Allies. If there were any doubts about Allied supremacy in the air, not merely on any one particular front but in the whole of the Allied air forces, they will have been set at rest by this frank and certainly not boastful pronouncement. Mr. Power told no more than the plain truth, and it is well that it should be generally realised.

Single-engined Training

FROM remarks we hear made in many quarters, it would seem that there is a tendency to assume from Mr. Power's remarks that single-engined training is to be heavily curtailed. What he said was that certain training schools which had hitherto been training fighter pilots would be reorganised for training navigators, bomb aimers, flight engineers, air gunners and wireless operators for bomber squadrons.

There is thus only a very general reference to pilot training. Briefly outlined, the scheme of training in Canada is that *ab initio* training starts on Cornells and Tiger Moths. The pupils then pass on to Harvard IIs, Ansons IIs and a smaller number to Oxfords. The Harvard II is a very popular training type, not only because it is a small aircraft and takes up little space in hangars and outside parks, but because it is very easy to maintain and service.

There is, of course, one feature of single-engined training aircraft such as the Harvard which is apt to be somewhat distressing to pupils. With the tail down, the view forward is completely blotted out, and pilots who have returned from twin-engined flying sometimes dislike this fact intensely. Most of them accustom themselves to it after a time, and then like the machine.

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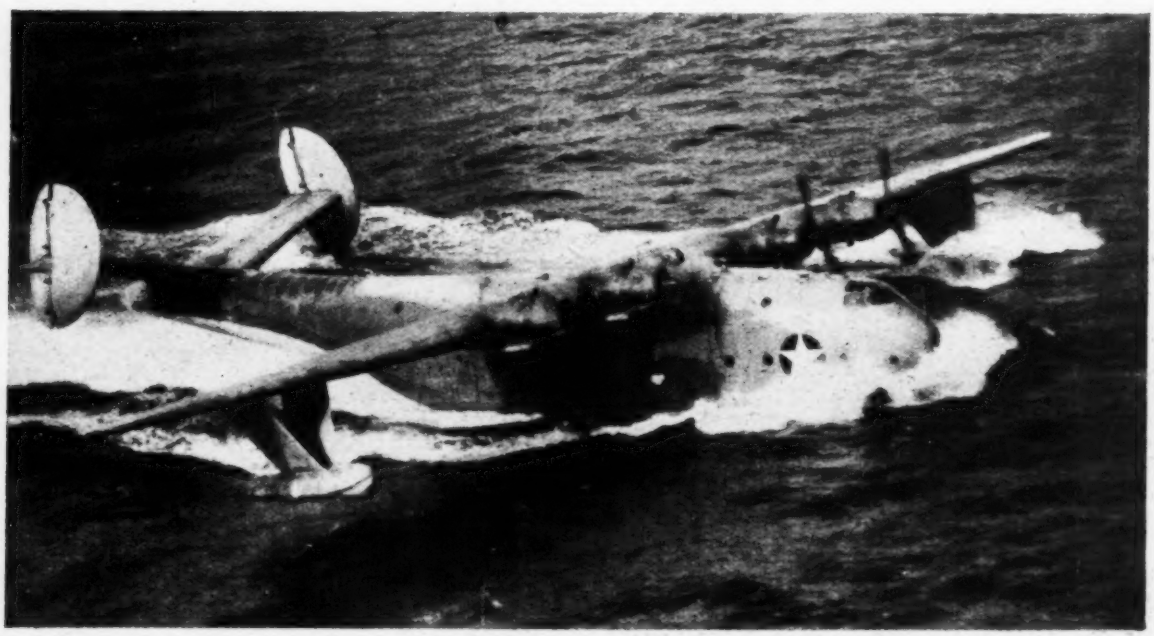
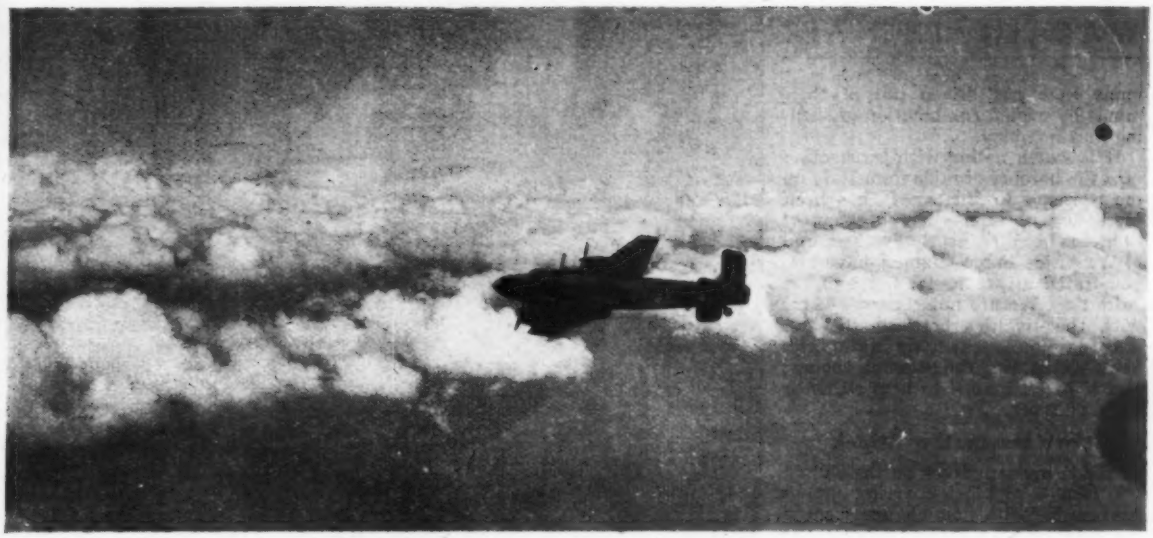
Canadian experience has shown that it is much easier to change a pupil from single-engined to twin-engined types than vice versa. For instance, no especial difficulty has been found in changing from the Harvard to the Mosquito. On the other hand, pilots returned from twin-engined flying to refresh themselves in aerobatics frequently have very considerable difficulty in picking up the threads again. It is difficult to give very much experience in aerobatics on twin-engined types, yet even pilots of heavy bombers have to indulge in a fair amount when taking evasive action, for example.

Germany based not only her production but her training programme on a preponderance of bomber types. When the Allies proved that they could mount a heavy bombing offensive, Germany had to change her production and her training to fighters, and it has been proved quite conclusively that, except for a relatively few highly skilled pilots, German pilot training is not up to our standard. She has had to switch many pilots over from bombers to fighters, and the result is readily observable.



GOD OF WAR: The 70-ton Martin Mars warming up its engines prior to taking off for a non-stop flight of 34 hr. 17 min. This flight was a final test before the flying boat was handed over to the U.S. Navy. Another view of the Mars, and details of the flight, are on page 660.



OFF ON A JOB : A Halifax Mark II, with the new fins and rudders, above the clouds.

WAR in the AIR

Bombs Support Shells in the Apennines : American Carriers in Pacific Offensive : Success of Anti-submarine Air Campaign

WINTRY weather in Italy has inevitably cut down the amount of air support which the two Armies under the command of General Alexander have received. At the end of the Tunisian campaign Air Marshal Coningham foretold that this would inevitably happen. None the less, the Tactical Air Force has gone out whenever the weather has made it possible for its machines to fly, and has added its quota to the terrific bombardments which the Allied artillery has directed upon the German positions. From all accounts, the air support mostly took the form of low-flying bombing by fighter-bombers. The Germans held doggedly on to their positions, but many prisoners taken seemed dazed to the point of insanity by the hail of explosives which had been showered on their heads. It is not possible to say whether the shells or the bombs played the greater part in producing this effect, or which did most damage, but the German infantry very probably found the bombing the most demoralising element.

Many of these German prisoners may have been raw troops who were facing the British and Americans for the first time. Rommel's African veterans have been accustomed to carrying on for a long time against the handicap of British air superiority. They even drove Auchinleck's men back to Alamein in spite of British superiority in the air. The German High Command, in its endeavour to make the most of its inadequate air strength, evidently decided that its troops in Italy could be required to stand up to Allied attacks from overhead without help from the *Luftwaffe*, and withdrew squadrons from Italy to send to Russia, and elsewhere. In making this decision, the Germans doubtless reckoned on the bad weather of the Italian winter, and also on the fact that their men would make their stand in the Apennines. Even in good weather, a mountainous terrain reduces the effectiveness of bombing. The steadfastness with which most of the German posts held out proves that the decision was justified, for obviously the majority of the Ger-

WELL DESERVED : Ground crews, who work in the open in all weathers, have been issued with special winter kit to keep them both dry and warm.

WAR IN THE AIR

mans were not driven out of their minds by even a combination of shelling and bombing.

It is worth noting with satisfaction how the number of raids from Italy on the Germans in Yugoslavia has been increasing of late. The harbour of Split has been frequently bombed, and N.W. Africa Force bombers have also penetrated up to the far north of the Adriatic. We are not concerned here with the rivalries between the two Yugoslav forces which are in the field. Both are fighting the common enemy; and it is good work to help either or both of them.

Carriers in the Attack

THE American attack on the Gilbert Islands and neighbouring groups has marked the first change from a defensive-offensive off the coasts of Australia to a real offensive against Japanese positions which form an outer bastion to the group of home islands. Many gallant feats of arms were performed by Americans in these operations, which were essentially naval in character, but relied to a great extent on the land and air forces which are ancillaries of naval power, namely, the Marines and the aircraft carriers.

The United States Navy is working out a plan for the use of carriers in an offensive operation. There are no precedents from previous wars to guide them, and they are obliged to proceed more or less by the method of trial and error. Much the same might be said about the British use of carriers during the Salerno landing. Many points have to be studied, such as the risks which should legitimately be taken with large carriers, and also the risk to fast-landing fighters when small convoy carriers are used. It has also to be decided how far the special requirements of ship-borne aircraft handicap them in competing with shore-based machines. The theory that the latter must necessarily be overwhelmingly superior seems now to be challenged in certain quarters; and it may be that the numbers which airfields on land can sometimes send up against a small force taking off from a few carriers are a more important factor than the complications of possessing a landing hook and the ability to fold wings. The answer to that is more carriers, and the Americans have been building large numbers. So far as can be judged from reports received, the Americans are using their carriers to very good effect in their offensive operations.

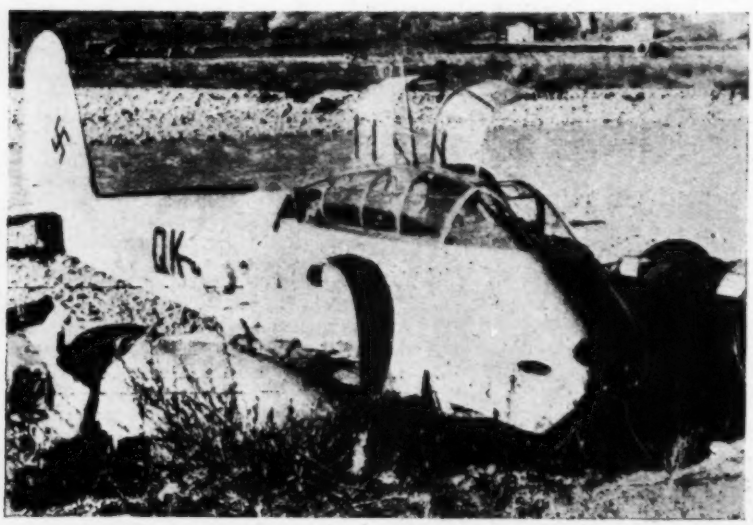
IT'S IN THE BAG: Norwegian paratroops packing weapons into the special arms-containers which are dropped at the same time as the men go down.

An interesting sidelight on future developments in the war is given by the news that in America the production of aircraft no longer is given first priority. That priority has now been given to landing craft, and it is said that the number needed amounts to 80,000 craft of all types. The U.S. Senate has passed a Bill authorising the Navy to spend the equivalent of £1,325,000,000 on the construction of landing and patrol craft.

Aircraft versus U-boats

TO win the Battle of the Atlantic has always been rated as a *sine qua non* of Allied success in the war. Of late things have been going well, so well, in fact, that President Roosevelt and Mr. Churchill themselves have issued a joint statement on the subject. They have told the world that the number of merchant vessels sunk by U-boats in November was smaller than in any month since May, 1940. They mentioned the great advantage conferred on our aircraft by the ability to use the Azores. The U-boat commanders have been learning caution, and so have offered fewer opportunities for the Allies to destroy them, but in spite of this the number of U-boats sunk in November again exceeded the number of their victims.

An excellent broadcast last week by an officer of Coastal Command brought the matter vividly home to the ordinary listener. He described how the tactics in the struggle have been varied many times. First the aircraft forced the U-boats to dive, and so cut down their speed of progress. To counter that, the enemy



IN THE BANK: A Messerschmit 210 down on the banks of the Sangro river in Italy. It was shot out of the sky by 8th Army A.A. gunners.

WAR IN THE AIR

took to moving on the surface in formation and fighting it out with heavy *flak* armament. This was what Coastal Command had been almost praying for, and they proceeded to attack with great enthusiasm. The aircraft which had spotted the formation would, of course, summon assistance, and other aircraft in the neighbourhood would fly to its help. When a naval force was at hand, that would also join in, and it was better equipped than the aircraft to effect the destruction of the U-boats. The co-operation between the Services was as close as it ought to be. The V.L.R. aircraft naturally did the bulk of the spotting, and consequently of the attacking. The U-boats have lost so heavily of late that it seems they will now have to think out some new form of tactics. The old expedient of diving offers safety, but diminishes the chance of doing the job for which the boats were sent to sea.

Another Atlantic Victory

THE U-boats have suffered another telling defeat in the Atlantic, the second within a week. Two valuable convoys were threatened by strong wolf-packs of German submarines, but the latter were vigorously attacked by aircraft of Coastal Command and by the escort ships of the Royal Navy. The aircraft sank three U-boats for certain and damaged two more, while the surface craft accounted for two certainties. Three Coastal Command machines were damaged in the fight, and two were forced to alight on the sea. Most of the crews were picked up by the naval vessels, but a few men were killed by the enemy's fire and a few more went down with their aircraft. The naval ships suffered neither damage nor casualties, but there were some losses among the merchantmen. The result was summed up by the remark that 99 per cent. of the escorted ships reached harbour in safety. The battle lasted for two days and two nights and was spread over a wide area.

ENEMY AIR LOSSES TO DEC. 11th

	Over G.B.	Continent	Middle East	N.W. Africa
Dec. 5	0	0	0	1
" 6	0	0	0	10
" 7	0	0	0	6
" 8	0	0	0	4
" 9	0	0	0	0
" 10	4	1	0	11
" 11	0	0	0	1
	4	1	0	33

Totals: West, 7,783; Middle East, over 5,757; North-West Africa, 3,745.

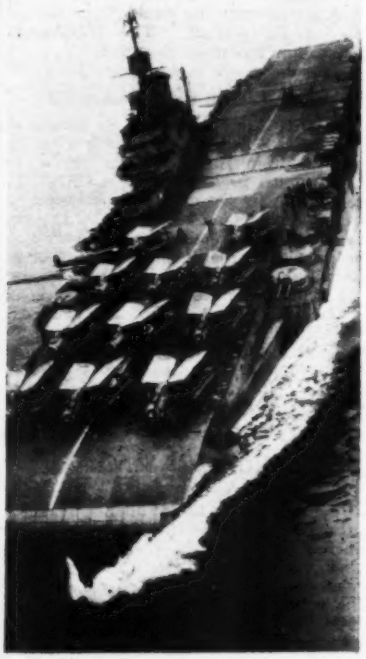
Obviously, such a satisfactory result could not have been attained but for the part played by the aircraft, with their wide range, speed and power of long sight. Their present armament with depth charges and equipment with Leigh lights has tremendously increased their striking power, though when surface ships can get to grips with the U-boats they have more depth charges at their disposal, and can also use their guns. The combination of the craft of the two Services is pretty well ideal.

A special tribute is due to one Sunderland with a mixed crew, partly R.A.F. and partly R.C.A.F., which severely damaged one U-boat, and despite casualties and damage pressed home its attack in a most heroic manner, and was finally forced down in the water, where it broke up. The very gallant captain, Flt. Lt. P. T. Sargent, of Toronto, went down with his boat.

Field Marshal Smuts, a man who is cautious in his use of words, declared in an interview at Nairobi that "the U-boat is beaten." He also said that the enormous effect of our bombing policy on Germany was the most important and considerable contribution to victory now being made—"I put it second to nothing else," he said. The reaction on *morale* was a secondary matter; the main target was Germany's war industries. Those words, from such a commentator, are, perhaps, the greatest compliment that Bomber Command has ever received.

During November four major attacks were made on Berlin, the most heavily defended place in Germany, but the losses of Bomber Command per 100 sorties were as low as in August.

Once more U.S. Liberators from North-West Africa, escorted by Lightnings, have made a daylight bombing raid on the railway yards at Sofia, the most important railway junction in the Balkans. This attack will, it is hoped, badly handicap the Germans in their efforts to deal with the growing activities of the bands in Yugoslavia and Greece. It should also dot the "i"s and cross the "t"s in Mr. Cordell Hull's warning to the satellite countries still actively helping Germany.



SEA-BIRDS: Albacore torpedo-bombers and a Seafire ranged on the deck of aircraft carrier H.M.S. *Indomitable*.

BRITISH & U.S. AIR LOSSES TO DEC. 11th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
Dec.					
5	0	1	0	0	1
6	0	0	0	0	2
7	0	0	0	0	0
8	0	0	0	0	7
9	0	0	0	1	4
10	0	2	0	0	2
11	0	19	3	0	1
	0	22	3	1	17

Totals: West, 8,705; Middle East about 2,339; North-West Africa, 1,400.

SPARE THE ROD: Bombing-up a Middle East Halifax with rodded (instantaneous fused) bombs for a raid where splinters not craters will do the damage.

"Type 'ere says you'd eat it all right if you'd seen what he's seen!"

HERE AND THERE

Assistant for P. Masefield

JAMES STANTON, formerly Public Relations Officer to the British Overseas Corporation, B.R.A.C., has been appointed as an assistant to Mr. Peter Masefield, personal adviser on civil aviation to the Lord Privy Seal, Lord Beaverbrook, and takes up his duties immediately.

New Timken Director

MR. LEONARD MORITZ has been appointed a director of British Timken, Ltd. He has been a director of Fischer Bearings Co., Ltd., for some years and since British Timken acquired control has been works director and responsible for substantial improvements in production.

U.S.-Indian Air Freight Service

THE first round trip of 28,000 miles involved in a new air freight service between Patterson Field, Ohio, and India was recently completed in 12 days.

This, the longest airline to be operated on a regular schedule, has been inaugurated by U.S. Army Air Transport Command, and although the exact route has not been disclosed, the fact that Puerto Rico, West Indies, lies on its course indicates that it crosses the Atlantic, Africa, and the Middle East.

Sir Alan Cobham's Prophecy

SIR ALAN COBHAM told the Royal Geographical Society recently that they were at present working on the problem of how to take heat from an aircraft engine and transfer it in correct doses to all parts of the wings and other parts of the aircraft liable to icing.

He did not think they were far from the time when they would solve the problem.

"I am quite sure," he added, "that before very long we shall have effective de-icing apparatus that will cure that trouble."

Growth of the R.A.A.F.

R.A.A.F. Overseas Headquarters say that in four years the R.A.A.F. has multiplied its peacetime strength more than 30 times, and that Australian squadrons stationed in Britain have completed 10,000 sorties and flown nearly 10,000,000 miles.

One R.A.A.F. bomber squadron alone has dropped a greater tonnage of bombs on Germany than was dropped in the first 12 months of the war, R.A.A.F. men in the U.K. have won more than 500 awards for gallantry, while Australians serving with the R.A.F. have gained another 203 "gongs."

In all war theatres, "Aussie" pilots and aircrew have won awards at the rate of almost one a day!

Canadian C.F.S. Chief

WING CDR. ALAN JOSEPH SHELFOON, A.F.C., of the R.C.A.F., has just been appointed chief flying instructor at the Empire Central Flying School—an appointment which is a further tribute to the part Canada is playing in the huge organisation which trains British and Dominions pilots.

Wing Cdr. Shelfoon, who comes from Toronto, succeeds Wing Cdr. A. Watts, a Canadian, who recently returned to the Dominion. He was formerly chief flying instructor at the Central Flying School, Trenton, Canada. He joined the R.C.A.F. on the outbreak of war, having done much civil flying and instruction.

150,000 of Them!

IT was recently announced by Mr. Frank Byrnes, Director of the Office of War Mobilisation in Washington, that the 150,000th U.S. warplane came off an assembly line on December 7th—the anniversary of "Pearl Harbour."

"The results of full mobilisation have been tremendous," he said. "The most critical and bloody battles of the war are ahead of us. This is not the time for us to take our eyes off the target."

He added that the unity displayed by the four great Allies in their recent conferences ought to inspire unity at home in America, especially in holding the line against inflation.

"Thicker Than Fleas ——"

SIX new airfields in East Anglia have recently been added to the great number of stations now dotted all over Great Britain. These six are for the U.S.A.A.F., and Lt. Gen. J. L. Devers, U.S. Commanding General in Europe, who attended a dedication ceremony at one of them, said, "The youth of America will take off from these airports to blacken the skies over enemy territory."

Quite a long while ago an American pilot, writing of his early flights in this country, picturesquely described airfields in Great Britain as being "thicker than fleas on a dog's back," and many more have been added since then.

More recently a visiting American editor, writing of a flight from Scotland to London, observed that airfields were so numerous that had their pilot "cut the motors" at almost any moment during the trip, he could have landed on an air station. The U.S.A.A.F. alone now has more than 100.

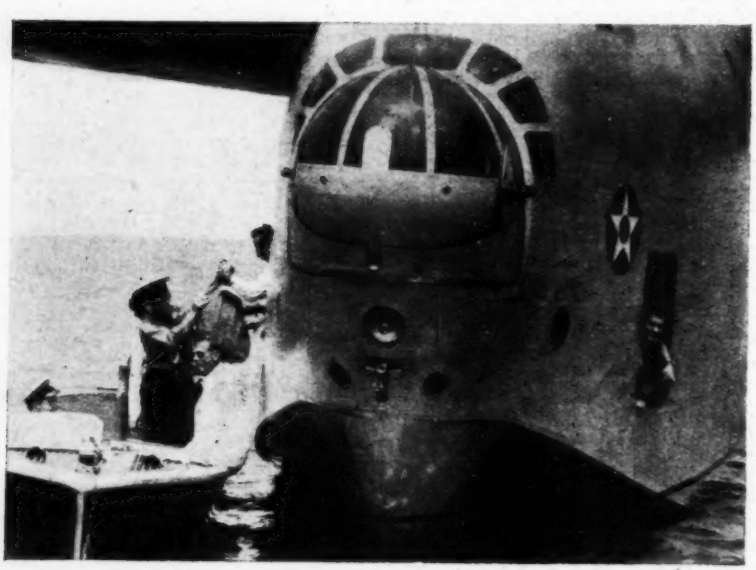
Canada-London Non-stop

WHEN Air Marshal L. S. Breadner, C.B., D.S.O., recently flew to this country from Halifax, Nova Scotia, to take up his new duties as A.O.C.-in-C. the R.C.A.F. Overseas in succession to Air Marshal Harold Edwards, C.B., the Transport Command Liberator in which he travelled made the first non-stop flight from Canada to London. The time for the flight was 13 hr. 43 min.

With Air Marshal Breadner were Air Vice-Marshal M. R. Anderson, who succeeds Air Vice-Marshal W. A. Curtis as Deputy A.O.C.-in-C., Group Capt. C. C. P. Graham, and Wing Cdr. R. R. Morrow from R.C.A.F. headquarters in Ottawa.

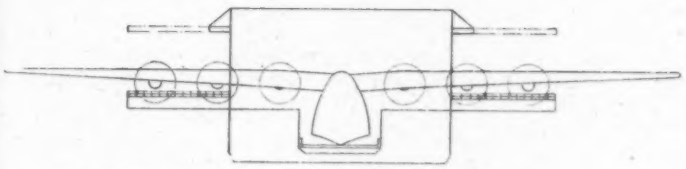
Microgram Service

WHEN we described, in our December 2nd issue, the Williamson Microprinter and Multiprinter machines for reducing documents to 35 mm. or 16 mm. cinematograph size, afterwards enlarging them on to photographic paper, we used the word "Airgraph" in the sub-title. It has been pointed out to us that this word exclusively denotes the service carried out for the Post Office by Kodak, Ltd., in sending "Airgraph" letters to His Majesty's Forces overseas and to civilians in many parts of the world.



RECORD-BREAKER: The world's largest flying boat, the 70-ton Martin Mars, was recently handed over to the U.S. Navy for final trials and flew 4,375 miles nonstop and without refuelling, in 34 hr. 17 min. On the return trip it carried a record 35,000 lb. load in its 117ft. hull. Four 2,000 h.p. Duplex Cyclones provide the power; span is 200ft. Another picture is on page 656.

'Where Angels Fear —'



Will There be a Place for the Flying Boat? : A Critical Review of the Saro Report

By C. A. H. POLLITT

THE article in *Flight* dated November 25th, in which the case for the flying boat was so clearly stated, served to revive one of the most debatable aeronautical topics of our time.

The article in question leaves no doubt as to the potential merits of the flying boat as opposed to its landplane counterpart, and surveys in some detail the fundamental differences contributing to the merits of each.

While avoiding an elaborate analysis of their respective merits, the Saro report confines itself to a summary of the more important advantages of the flying boat, which attitude is understandable and just. From this summary, which one is bound to admit is comprehensive and detailed, there emerges the fact that there is but one major fundamental difference between the flying boat and landplane of similar size, and this appertains to the undercarriage problems.

At the risk of rushing in where angels fear to tread, I venture to ask, " Will there really be a place for the flying boat in the post-war era? " The overwhelming majority will doubtless incline to the view that the flying boat will assuredly have a definite rôle to play in establishing our future air commerce, but let us pause to reflect.

Town and Terminus

One recalls that in the immediate pre-war years it was possible to fly from Paris to Croydon in something like 90 minutes which, for the sake of argument, we will say was a reasonable performance. But what of the journey from Croydon up to town? By ordinary surface travel another 50 minutes was invariably involved in covering this relatively short last lap.

Now this is an indication of the handicaps likely to beset the flying boat which, after all, can only content itself with coast-to-coast transport and is, therefore, likely to fall short of a landplane service.

To quote an analogy. If Mr. Blank, whom we will assume to be the head of an industrial concern in the Midlands, should require to travel by air from Birmingham to Johannesburg, he will probably find himself obliged to travel 100 miles or more to the nearest flying-boat base. This will very likely be somewhere along the South Coast of England, where he could emplane in a flying boat that would at best only get him to within 300 miles of Johannesburg. That is, assuming Durban to be the nearest port of call.

A landplane feeder service would doubtless facilitate this latter stage of journey, though one can hardly avoid the inference that a direct landplane service from his home town to his destination via some main landplane terminus in this country would be infinitely more convenient and would also waste less time.

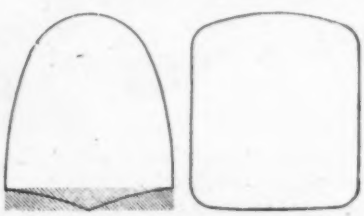
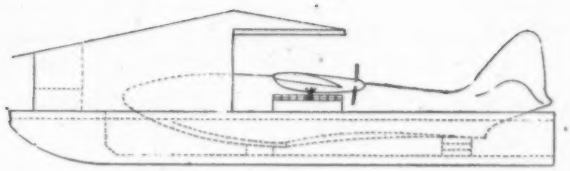


Fig. 1 shows the difference in hull space for fuselage and hull of equal dimensions.



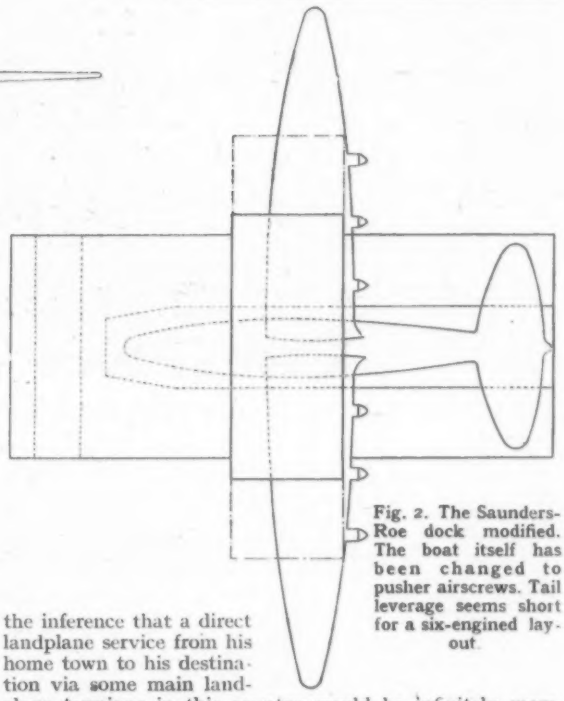


Fig. 2. The Saunders-Roe dock modified. The boat itself has been changed to pusher airscrews. Tail leverage seems short for a six-engined lay-out.

Structure Weight

The report makes the point that in the larger sizes of aircraft there will be an advantage in structure weight of at least 3 per cent. in favour of the flying boat. Personally, I am inclined to question this assertion, because it is abundantly clear that whereas the approximately rectangular cross-sectional shape of a landplane fuselage can be devoted almost exclusively to passenger or freight accommodation, the same is not true of the flying boat. The bottom of a flying boat hull embodying, as it must, steps and chines, cannot be satisfactorily utilised for stowage (see Fig 1), and although the ratio of profile drag to weight may tend to improve with the larger size of boat, due presumably to such refinements as streamline retractable steps, chines and wing floats, etc., etc., the consequent ton-mileage loss will be at least equivalent to the 3 per cent. structural weight handicap with which the landplane is charged. Hence it is true to say that so far as fuselage or hull structure weight is concerned, the difference, if any, is negligible.

Another thorny problem is that of maintenance. The floating dock featured in the report is indeed a commendable effort to lessen the difficulty, though it still leaves a certain amount to be desired. For instance, it is not clear what access is provided for the purpose of overhauling the two outboard power plants on each wing. Obviously, access for slinging is amply catered for by the sliding extension platform, but one wonders if some self contained form of maintenance platform is also necessary, say a hinged leading edge as on the Empire boats. This, of course, strikes at the kernel

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'WHERE ANGELS FEAR ——'

of the problem, particularly if we envisage a power plant of the not very-distant future, which may be in the form of an engine buried in the wing, or perhaps even a jet propulsion turbine. A not extensive modification to the proposed floating dock would, I believe, render it equally suitable for the maintenance and overhaul of such future power plants, and would at the same time eliminate the need for carrying engine maintenance platforms as ancillary equipment. I have taken the liberty of modifying the original scheme and append the alternative herewith. (See Fig. 2.)

One somewhat misleading part of the report is that which strikes a comparison between British and American flying boats. This creates the false impression that flying-boat development in the United States has flourished in consequence of a greater readiness to appreciate the merits of the type, and the number of flying boat types so far produced in America is offered as confirmation of this argument. Actually such is not the case. In fact, it would be more correct to ascribe the variety of American flying-boat designs to geographical considerations far removed from any inherent advantage of the type as a whole.

Let us make no mistake about it: British civil flying boats are the envy of the world and are certainly second to none. Compared with their American contemporaries our civil boats have only one shortcoming—a numerical inferiority—the significance of which, in the technical sense, is precisely nil.

By and large, the report leaves one with the impression that, although there are no major fundamental differences between the flying boat and landplane as commercial transports, there will be a marked advantage in favour of the flying boat with each successive increase of size and weight. Against this I would set two inherent failings—

1. Broadly speaking, the flying boat can only provide coast to coast transport, so that in effect it is only doing part of the job.

2. The ton mileage loss of payload due to sacrificing internal space to an arrangement of steps and chines may be sufficient to turn the scales in favour of the landplane.

Fortress Evolution

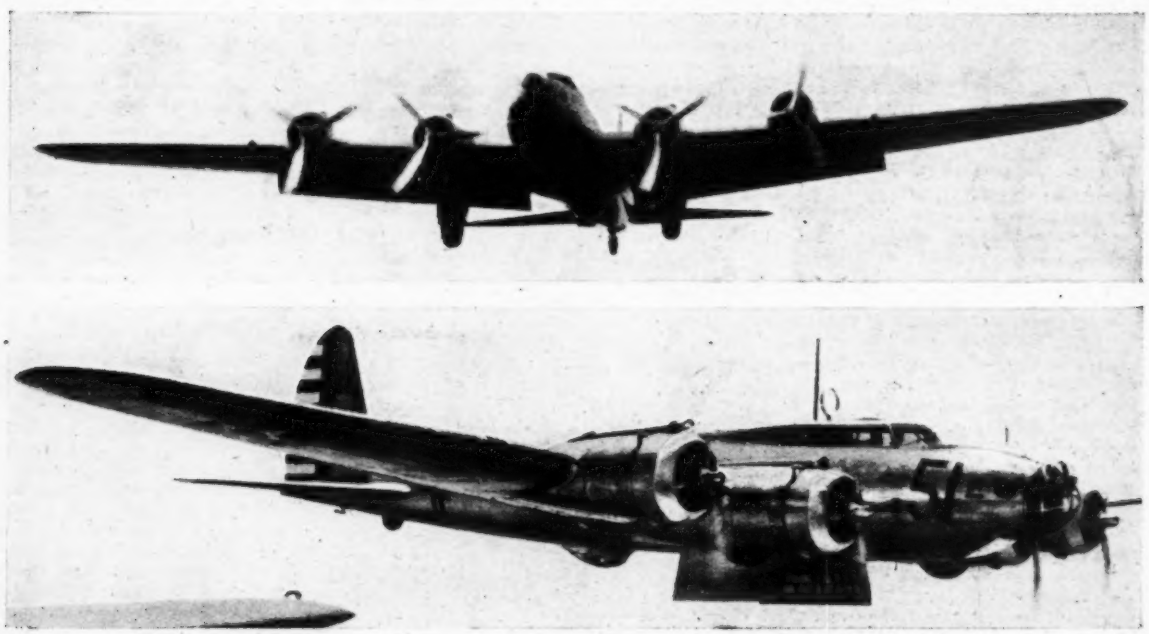
From Blisters to Power-operated Turrets : But Bomb Load Still Limited

THE recent introduction of the B-17G, the Flying Fortress II with the new chin turret, marks the eighth in the line of Boeing B-17s since the first batch of 13 "service test" models were delivered to the U.S.A.A.F. during the first seven months of 1937. It is therefore interesting briefly to trace the evolution of the type from its prototype to the current version, especially as the advent of the new "Super Fortress," B-29, already in steadily increasing production, may well mean that the B-17G represents the final phase of the type's development.

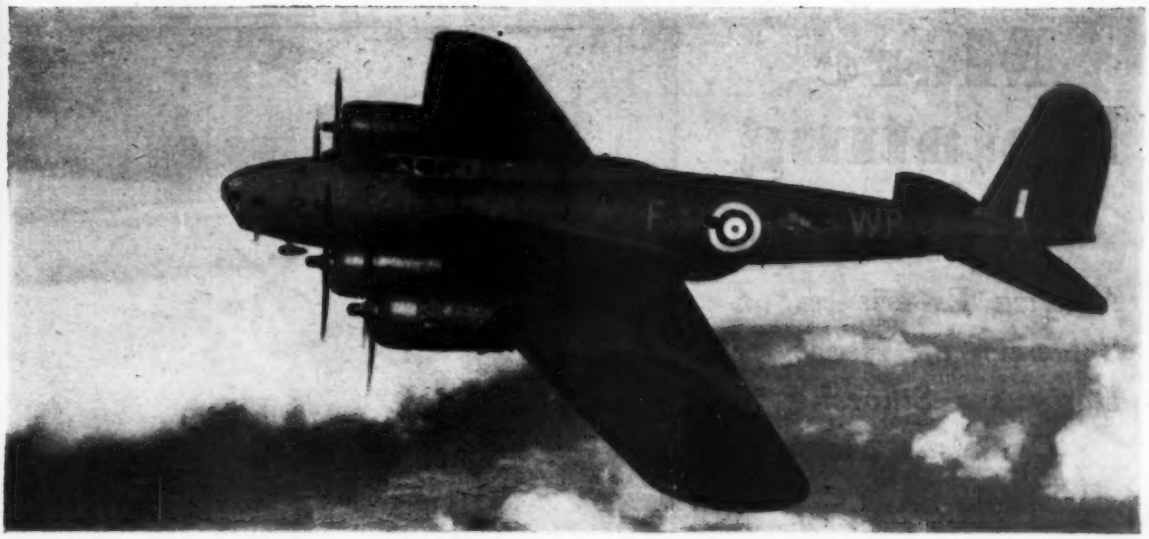
Forerunner of the Flying Fortress and prototype of the B-17 series was the Boeing 299. Built in 1935, it constituted a striking advance in the field of military bombers at a time when Great Britain and the R.A.F. classified twin-engined Wellingtons and Whitleys as "heavy," and it was followed by the "service test" B-17s and one experimental B-17A.

Between July, 1939, and March, 1940, Boeings delivered 39 Flying Fortresses, B-17B, to the U.S. Army, after which came the B-17C, with "improved armament," 38 of which were produced by November, 1940. These aircraft had 1,000 h.p. Wright Cyclone engines instead of the 700 h.p. Pratt and Whitney Hornets originally employed.

The next advance was the B-17D, whose chief improvement was the fitting of leak-proof fuel tanks, but it still was armed only with a few hand-operated "blister" guns. In all, 42 of these were built up to September, 1941, and some of these were acquired by the R.A.F. under the official name of the Flying Fortress I. The new B-17E differed greatly in its fire power as well as in appearance. Gun turrets mounting pairs of 0.5in. machine guns appeared above, below and in the tail, in addition to one or two "free" guns in the nose. The fuselage was longer, the tailplane bigger, and the fin sprouted



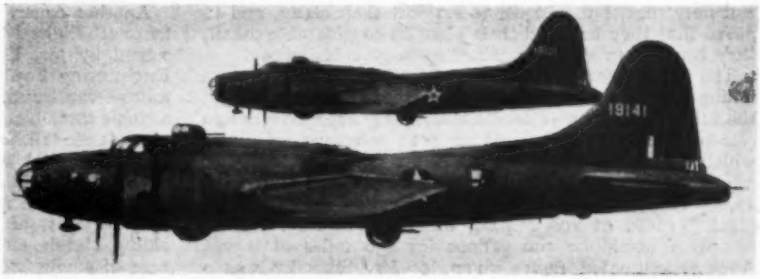
FROM PROTOTYPE TO PRODUCTION: The Boeing 299 (top) was the forerunner of the Flying Fortress and was built in 1935. It had four 700 h.p. Pratt & Whitney engines and manually operated 0.5in. machine guns in nose, side blisters and ventral position. After this came thirteen test models of the B-17, a solitary experimental B-17A, and then (below) the B-17B production Fortress I with 1,000 h.p. Wright Cyclones and improved (but still inadequate) armament.



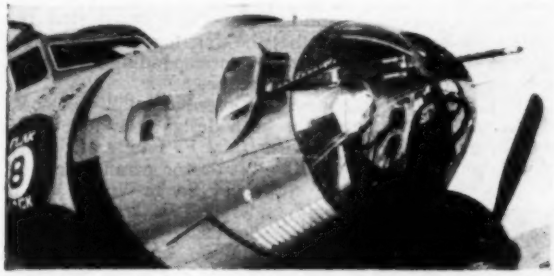
R.A.F.'S FIRST : After 39 B-17B's and 38 B-17C's had been produced for the U.S.A.A.F. during 1939-40, Boeings introduced the B-17D with leak-proof fuel tanks and turned out 42, some of which were handed over to the R.A.F. in 1941.

the large dorsal fillet now so familiar. This was the Flying Fortress II in the R.A.F., and the B-17F and B-17G embrace only changes in the nose. The "F" introduced the frameless moulded plastic nose and the "G" added a chin turret with yet another pair of "point fives," while still providing for additional "free" guns if and when required to a total of 13 defensive weapons. Power is supplied by four 1,200 h.p. turbo-supercharged Wright Cyclones.

Throughout all this, however, the



FORTRESS IN FACT : The B-17E, or Flying Fortress II, was the first to be armed with power-operated gun-turrets. 1,200 h.p. Cyclones, longer fuselage, larger tail surfaces and other improvements were embodied also.

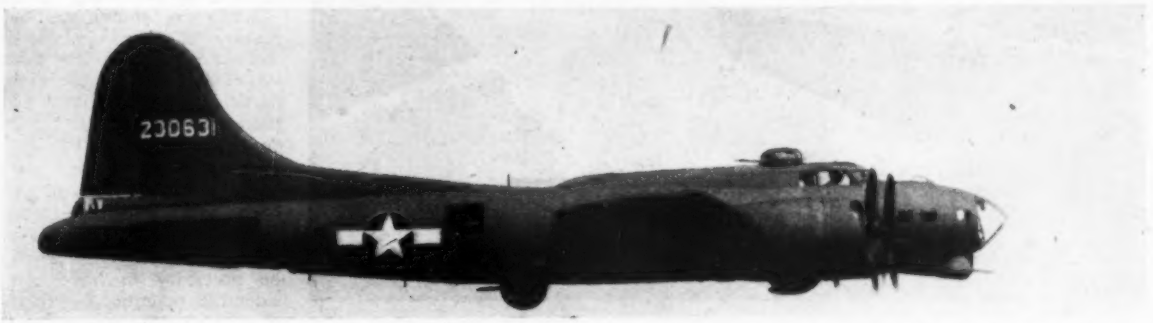


NEW NOSE : A frameless moulded plastic nose distinguished the B-17F. This was later modified to accommodate three guns, as shown, with increased field of fire.

bomb load has remained substantially the same, and claims of having increased the bomb load of the Fortress II to ten (American) tons are very misleading to say the least.

The facts of the case are these: a bomb load of round about this figure *can* be crammed on to a Fortress II by hanging 4,000 lb. block-busters on the external wing racks, but only at the expense of cutting down the range to a virtually useless figure. Furthermore, such a load involves a perilously long take-off run, since it pushes up the wing-loading enormously.

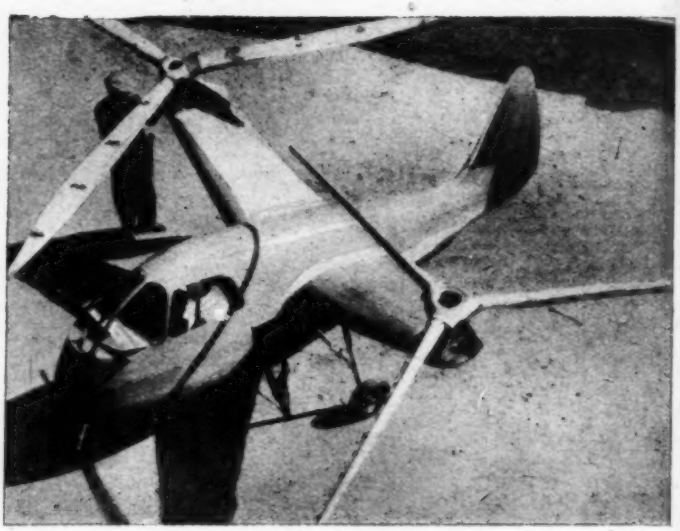
On operational flights the Fortress II (largely because of its heavy defensive equipment) can carry an internal bomb load of some three tons, and this can be increased to, perhaps, five tons by means of the wing-racks.



FORTRESS FINALITY ? : The addition of a chin turret with another pair of 0.5in. machine guns brings us to the B-17G. As the new B-29 is now in production, this version of the Fortress II may mark the completion of the type's evolution.

More Rotating Wings

America Experiences an Epidemic of Helicopter Designs : Sikorsky in Optimistic Mood



The Landgraf helicopter is built largely of plywood and is "clean" for a twin-rotor type.

SOMETHING very like a bombshell was thrown into American aviation circles recently by the Greyhound Corporation of Chicago, a concern operating large numbers of buses, who applied for permission to operate 78 helicopter routes covering 49,000 air miles. Not only that, but in order to support their claim, and to prove that they had laid their plans in considerable detail, they brought in Mr. Igor Sikorsky to give testimony.

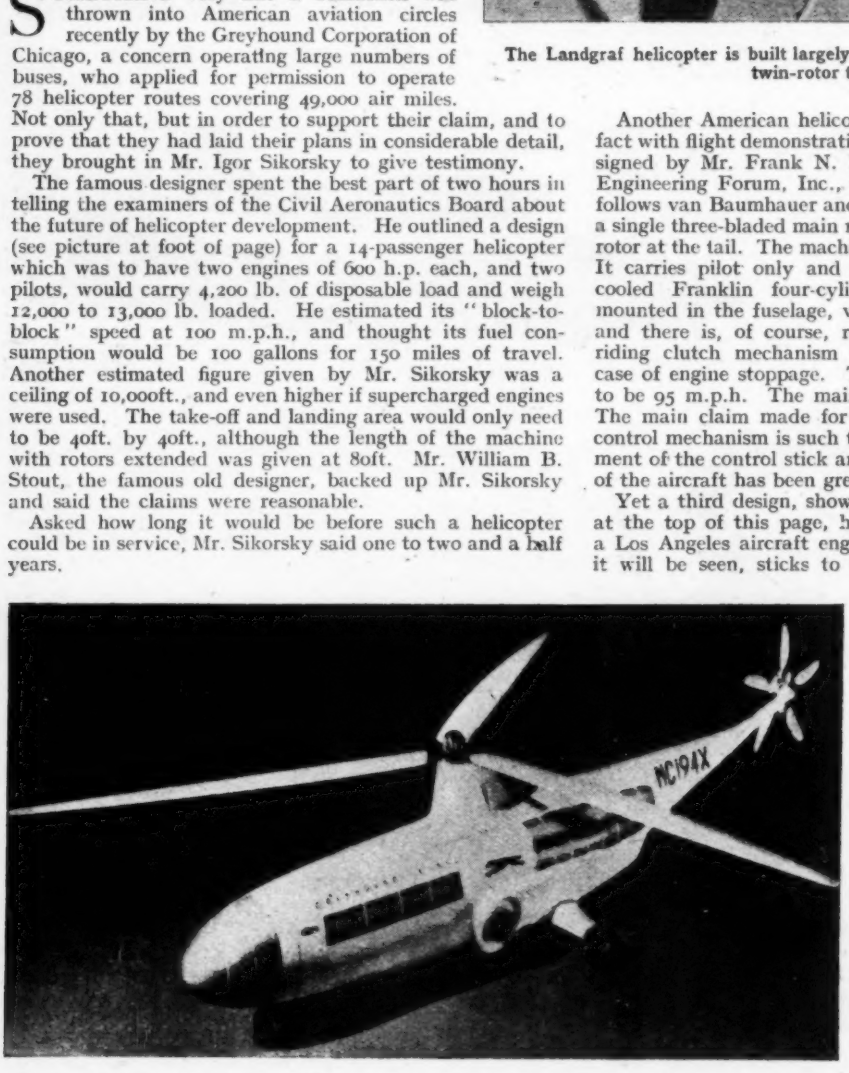
The famous designer spent the best part of two hours in telling the examiners of the Civil Aeronautics Board about the future of helicopter development. He outlined a design (see picture at foot of page) for a 14-passenger helicopter which was to have two engines of 600 h.p. each, and two pilots, would carry 4,200 lb. of disposable load and weigh 12,000 to 13,000 lb. loaded. He estimated its "block-to-block" speed at 100 m.p.h., and thought its fuel consumption would be 100 gallons for 150 miles of travel. Another estimated figure given by Mr. Sikorsky was a ceiling of 10,000ft., and even higher if supercharged engines were used. The take-off and landing area would only need to be 40ft. by 40ft., although the length of the machine with rotors extended was given at 80ft. Mr. William B. Stout, the famous old designer, backed up Mr. Sikorsky and said the claims were reasonable.

Asked how long it would be before such a helicopter could be in service, Mr. Sikorsky said one to two and a half years.

Another American helicopter, this time an accomplished fact with flight demonstrations to its credit, is the PV-2, designed by Mr. Frank N. Piasecki and built by the P-V Engineering Forum, Inc., of Philadelphia. This machine follows van Baumhauer and Sikorsky practice in that it has a single three-bladed main rotor and is controlled by a small rotor at the tail. The machine is said to weigh but 1,000 lb. It carries pilot only and is powered by a 90 h.p. fan-cooled Franklin four-cylinder engine. The engine is mounted in the fuselage, vertically below the rotor shaft, and there is, of course, reduction gearing and an over-riding clutch mechanism which ensures autorotation in case of engine stoppage. The maximum speed is claimed to be 95 m.p.h. The main rotor has a diameter of 25ft. The main claim made for the Piasecki PV-2 is that the control mechanism is such that the time lag between movement of the control stick and the corresponding movement of the aircraft has been greatly reduced.

Yet a third design, shown in somewhat unfinished form at the top of this page, has been designed and built by a Los Angeles aircraft engineer, Mr. F. Landgraf. This, it will be seen, sticks to the twin-rotor arrangement of the old Focke-Wulfe, but is certainly a good deal "cleaner," the rotors being mounted on wing-shaped members in place of the open-work girders of the German helicopter. The rotors of the Landgraf helicopter have a diameter of 16ft.

While applauding the ingenuity of these designers, one cannot help feeling that Mr. Sikorsky is a little optimistic in thinking that a 14-passenger type could be in operation in even 2½ years. Hitherto no helicopter with any appreciable pay load has been built, and before the general public could be entrusted to a new type it would be necessary to have considerable operational experience, even if it were assumed that technical problems had been solved.



Model of Sikorsky's twin-engined 14-passenger design. It was produced as proof of an American bus company's seriousness in applying for permission to operate helicopter feeder-line services.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

From Hungary

THE Horthy Flying Academy at Kassal (Hungary) held a cadets' ceremonial passing-out parade. The Academy, which trains future officers of the Hungarian Air Force, has been named after the Regent's son, who lost his life on active service during this war.

Air Support

LUFTWAFFE Stuka units are reported to be taking part in operations against Italian patriots. In the Bergamo area, near Lago Maggiore, and at Pian del Re, near Cuneo, pitched battles are taking place between Italian patriots, supported by some released Allied prisoners, and German troops stationed in the districts.

Vanishing Trick

A SWEDISH newspaper reports from Berlin that the courier aircraft flying between Berlin and Stockholm has mysteriously disappeared. The aircraft is said to have carried diplomatic mail for the Hungarian Legation in Stockholm, and it is feared there that important documents might have fallen "into the wrong hands." Five days after the aircraft was due to arrive its whereabouts were still unknown.

Recruiting

NORWEGIAN quisling newspapers appeal now to the youth to join the Hirdens Flycorps, an organisation run on lines of the Nazi Flying Corps and Hitler Youth.

The study of aviation—it is said—has stopped almost completely since the war, and the HFK is now organising courses for model construction, gliding, and elementary flying training. With the assistance of Germans who are interested in building up a potential recruiting source for the *Luftwaffe* in Norway, instruction at these courses, food, and travelling is offered free of charge. As a special incentive for young men to join, it is announced that extra food rations will be given to all participants.

To facilitate recruiting, membership of the Norwegian Nazi Party is not made a condition of entry, but applicants for courses must be Norwegians of pure Northern blood.

Background

HITLER'S so-called "secret" weapon is neither secret nor German, says a Swedish commentator. The rocket projectile corresponding to description of the type developed by the Germans is in fact of Swedish origin, having been invented a few years before the war by Anders Gernant, the son of a Swedish industrialist.

Preparing for Future

BAILIFFS in Germany have now been given a new function. They are no longer sent out to confiscate the furniture of people who have defaulted in paying their taxes. In future they will be employed to estimate the value of household and industrial equipment destroyed in air raids.

Satellite Industry

REPORTING on Hungary's industry, the *Neues Wiener Tagblatt* says that 22,000 industries are engaged in the production of machines, and 24,000 business enterprises employing some 25,000 men are in the metal and iron trade.

Hungary has about a quarter of a million of small industrial enterprises which produce nearly 40 per cent. of the country's total industrial output.

Italian Production

QUOTING an article in the Mussolini-controlled *Giornale d'Italia*, German radio says that the most important aircraft factories in Northern Italy are again in working order and "producing most modern aircraft." It is emphasised that the management of plants remains Italian.

Mussolini's Secretary of State for Air, Ernesto Botti, is said to have appointed General B. A. Tessari to be in control of these factories.

Rockets Again—

IN the European Press, speculation around the much-heralded German secret weapons continues unabated. While many reports are probably enemy inspired, the comments of a Swedish expert may be of interest. "German quarters—he says—announce that a new weapon will wreak a fearful vengeance for the English air bombing. It would seem to be a new radio-controlled torpedo or rocket weighing tens of tons. A firing range of hundreds of kilometres is mentioned. It is not impossible to turn out such monsters, but they will not be precision weapons. If the firing range is so great, the misses, too, will have to be calculated in tens of kilometres. The accuracy would be improved with radio control, but then it would be possible for the opponent to divert the missile from its true course by radio interference. In missiles of this size, too, the driving power will take up much room, and the explosive charge will be relatively small."

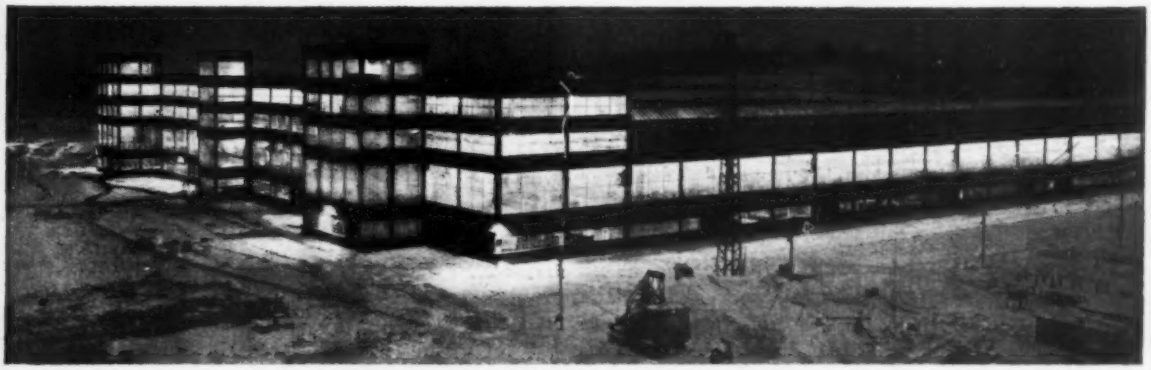
—and Aircraft

OTHER Swedish and Spanish sources give vague suggestions of a new bomber being built in Germany. This is said to be a four-engined aircraft, the German reply to the Allied "heavies," equipped with rocket-assisted take-off, heavy bomb load, and high speed.

Conflicting reports mention also the application of new propulsion methods to give the bomber additional speed, while one neutral report professes to know that the machine is a Heinkel 178.

Rubber Shortage

BOTH in Germany and in her satellite countries there is at present an acute shortage of rubber. The current production of German synthetic rubber, while still considerable, is exposed to bomber interference and cannot cope with Germany's war demands. Experiments with wooden wheels for bicycles and steel tyres for motor vehicles are reported to be in progress.



READY FOR BLITZ : The Opel *Blitz Lastwagenwerk*, one of the largest German assembly plants for army vehicles. For strategic reasons the plant was constructed in Brandenburg before the war by order of the Nazi Government. It was apparently thought then that this region would be immune from danger.

Seventy-n....h of the Current Recognition Series

Aircraft Types and

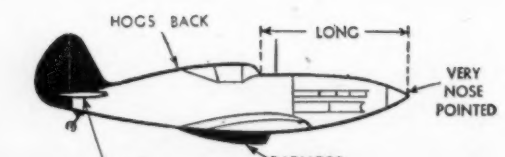
MIG-3 (I-61)

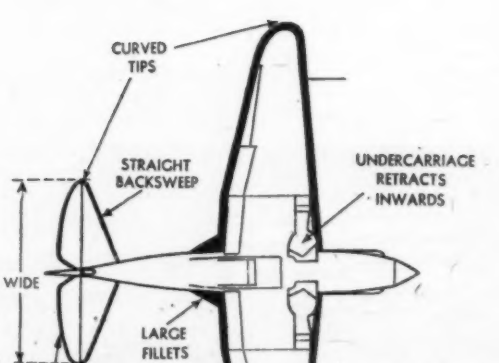
ACCOUNTED one of the best single-seater fighters in the Russian Air Force (it has often been called the "Russian Spitfire"), the Mig-3 was first designated the I-18, but later—presumably after further development—it became the I-61. The name of Mig-3, by which it is now more generally known, would appear to be a pun on an abbreviation of Mikoyan, the name of the man responsible for the carrying out of the later development work, since "Mig" in Russian means a twinkle or flash, and is an obvious reference to its speed.

When it came into service some time in 1941, the Mig-3 was easily the fastest Russian fighter, but its top speed of 360 m.p.h. has almost certainly been bettered by still later types, such as the YAK-7. Nevertheless, it still forms the standard equipment of many Soviet fighter squadrons and has wrought considerable havoc.

Powered by a liquid-cooled, Vee-type AM-35A engine which, with two-stage supercharger, develops a maximum of 1,200 h.p., the Mig-3 has various arrangements of armament according to the exact duties it is required to perform. Like our Hurricane and Spitfire fighters, it began life with eight wing-guns. A later model had one 0.5in. machine-gun above the engine and two 0.30in. machine-guns firing from blast troughs on each side of the cowling below the exhaust outlets, all synchronised with the airscrew. A third type is said to have two cannon and four machine-guns for low-level attacks on troops, etc.

Of all-metal construction with stressed-skin covering except for fabric-covered control surfaces, the Mig-3 bears a good general resemblance to a P-40 Tomahawk with radiator amidships in the Mustang fashion. Its tapered wings, however, are cranked and the wide undercarriage folds inwards. The tailplane has a backswept leading-edge and curved elevators ("wing-nut" style), and the fin and rudder also suggest Curtiss influence. The cockpit is well back over the trailing-edge.



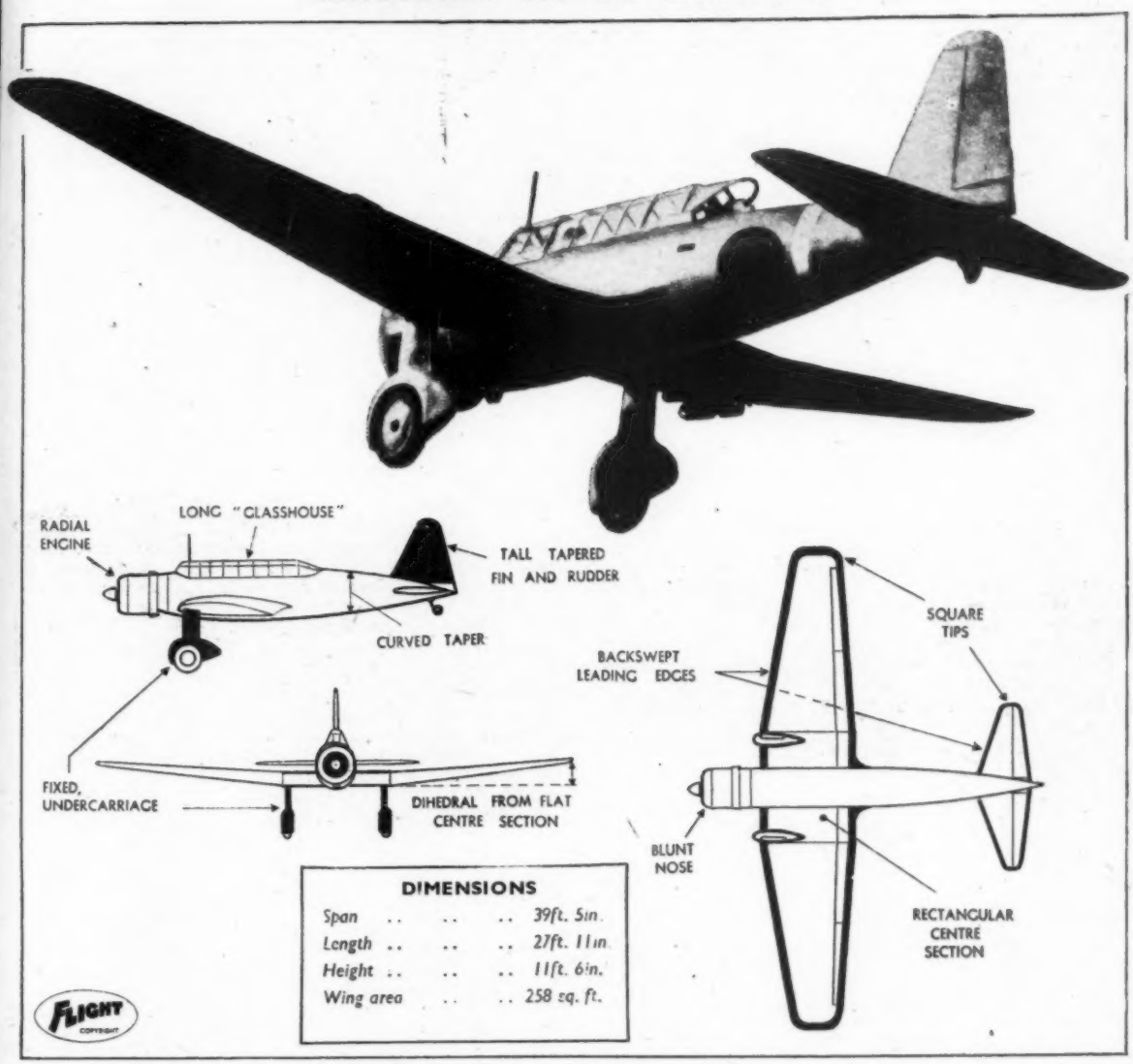


DIMENSIONS

Span	*37ft. 6in.*
Length	*31ft. 2in.*
Height	*10ft. 6in.*
Wing area	*240 sq. ft.*

...heir Characteristics

MITSUBISHI KB-98 (KARIGANE II)



NOTORIOUS copyists in all their engineering activities (even down to bicycles) the Japanese used the Northrop A-17 attack-bomber as their model for the series of light single-engined two-seater bombers introduced by the Mitsubishi concern under the type name of Karigane, which means Wild Goose.

As indicated by the designation KB-98, this aircraft was produced in 1938, the figures 98 standing for the Japanese year 2598, which is 1938 in our calender, since the Japanese calendar began in 660 B.C. The first Karigane, however, was built in 1936 as a high-speed civil type, and the following year two Jap pilots flew it in the record time of 3 days 22 hr. 18 min. from Tokyo to Croydon.

Powered by a Mitsubishi Kinsei 14-cylinder air-cooled radial engine ("Twin Wasp Junior" inspiration) developing a maximum of 900 h.p. at 10,000ft., the KB-98 has a top speed of 260 m.p.h., cruises at 200 m.p.h., and has a cruising range of about 1,500 miles. Long range is, in fact, a characteristic of most Japanese military and naval aircraft; in view of the geographical disposition of the "Rising Sun," this is a vital quality.

Of all-metal construction with alloy stressed-skin covering (except for the usual fabric on control surfaces), the KB-98 has a flat centre-section of moderate width and outer panels which taper slightly on both edges to broad, almost square, tips. Its tailplane tapers more on its leading edge and has similar tips, and the fin and rudder roughly match it in form.

The fuselage is an oval monocoque, tapering back to a point, and with the tandem cockpits covered by a long "glasshouse," while the fixed undercarriage has single, faired legs and spatted wheels. Armament consists of two 7.7 mm. machine-guns in the wings and a manually operated one in the rear cockpit. The normal bomb-load is 650 lb., and is carried beneath the wings, but may be increased to 1,000 lb. at some sacrifice of range.

Jettisoning Weight

Effect on the Gliding Characteristics of Aircraft

By P. F. ASHWOOD, B.Sc., D.I.C. and J. M. N. WILLIS, B.Sc., D.I.C.

IN recent issues of *Flight* there has been some discussion in the Correspondence columns regarding the distance travelled by a gliding aircraft and whether or not it is advantageous to jettison weight. In view of the topical interest of this problem in connection with the ability of a crippled aircraft to reach land after a bombing attack, the authors were of the opinion that a more aerodynamic approach to the problem would be appreciated.

In the following article the various factors governing the maximum distance that can be travelled by a gliding aircraft have been considered, and the effects of these are described.

In an analysis of this kind it is obviously impossible to treat the problem algebraically, and, therefore, fundamental data concerning the aerodynamic characteristics of the aircraft must be assumed. In other words, it is necessary to know the variation of lift coefficient, C_L and drag coefficient C_D with angle of incidence α. In the present example these values have been taken for a typical twin-engined machine similar to the Armstrong-Whitworth Whitley.

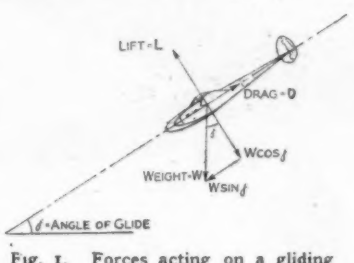


Fig. 1. Forces acting on a gliding aircraft.

The forces acting upon a gliding aircraft are shown diagrammatically in Fig. 1.

Resolving perpendicular to, and along, the line of flight we have

$$L = W \cos \gamma \quad \ldots \quad (1)$$

$$D = W \sin \gamma \quad \ldots \quad (2)$$

$$\text{hence } \frac{L}{D} = \cot \gamma \quad \ldots \quad (3)$$

where γ = angle of glide.

It follows that when $\frac{L}{D}$ is a maximum, the angle of glide is a minimum. Experimental results show that $\frac{L}{D}$ depends solely on incidence. Thus in order to travel the greatest distance *in still air* the aircraft must fly at the incidence corresponding to max. $\frac{L}{D}$.

We now have to consider the effect of wind velocity. The simplest conception of this is to imagine the aircraft flying in a very large volume of air which is itself moving relative to the earth's surface. Thus, while the motion of the machine with respect to the air remains unaltered, the air now has a velocity relative to the earth and the distance travelled will be increased, or decreased, by an amount proportional to the product of wind speed and time spent in the air, depending on whether the velocity of the wind assists or opposes that of the aircraft.

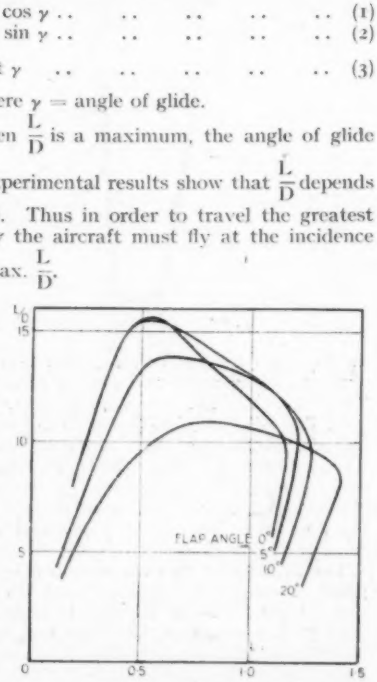


Fig. 2. Lift-drag ratio L/D plotted against lift coefficient C_L.

Turning now to a specific case, we will take as an example an aircraft having the following characteristics:—

Wing span, 88ft.
Wing area, 1,000 sq. ft.
Weight, 25,000 lb.

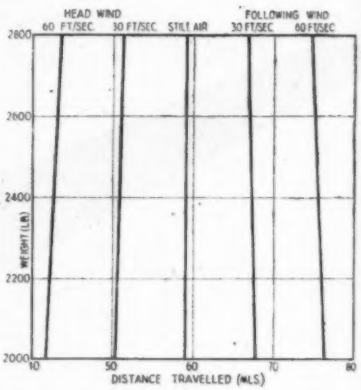


Fig. 3. Effect of weight on distance travelled (flaps closed).

The wing has slotted flaps with 100 sq. ft. total area. The lift and drag coefficients corresponding to a wide range of incidence and for various flap angles are known. From these, values of $\frac{L}{D}$ have been obtained and a graph of $\frac{L}{D}$ plotted against C_L is shown in Fig. 2.

Referring again to Fig. 1, we see that

$$L = W \cos \gamma \quad \ldots \quad (4)$$

Since the angles of glide are fairly small (of the order of 4 deg.) it is legitimate to assume that cos γ is approximately unity. The error introduced by this assumption is certainly not more than 0·3 per cent.

Thus

$$L = \tfrac{1}{2}\rho V^2 . C_L . S \quad \ldots \quad (5)$$

$$\therefore V = \sqrt{\frac{W}{\tfrac{1}{2}\rho C_L S}} \quad \ldots \quad (6)$$

where ρ = air density in slugs/cu. ft.
V = gliding speed in ft./sec.
S = wing area in sq. ft.

It will be noted that the air density appears in this expression, and since this varies considerably with altitude, being approximately half the ground level value at 20,000ft., it is obvious that the optimum gliding speed will not be constant at all altitudes. In the following example, the distances travelled when the glide is started at 20,000ft. are calculated, taking the air density to be the mean value between ground level and 20,000ft.

The rate of loss of height in a glide is V sin γ ft./sec. Since γ is small

$$V \sin \gamma = V \tan \gamma = V \frac{D}{L}$$

$$\text{Duration of glide} = \frac{HL}{VD} \text{ secs.}$$

where H = height at start of glide.

Distance travelled in glide

$$= H \tan \gamma + V_W \frac{HL}{VD}$$

$$= \frac{HL}{D} + V_W \frac{HL}{VD}$$

$$= \frac{HL}{D}\left(1 + \frac{V_W}{V}\right) \text{ ft.} \quad \ldots \quad (7)$$

where V_W = velocity of wind.

JETTISONING WEIGHT

Consider now the case in which the incidence is kept constant at that giving max. $\frac{L}{D}$ and the weight of the aircraft is varied. From equation (6), C_L being constant, it follows that reduction in weight leads to a decrease in gliding speed and hence the term $\frac{V_W}{V}$ in equation (7) is increased. Therefore, if the weight is reduced, the distance travelled is increased in the case of a following wind and decreased in the case of a head wind, $\frac{V_W}{V}$ being negative in the latter case.

Fig. 3 shows results calculated for the given example. It will be seen that, with a following wind of 60 ft./sec., a gain of only one mile can be made by jettisoning 3,000 lb. of equipment.

If the weight is kept constant and the incidence varied, $\frac{V_W}{V}$ is increased by increasing incidence. At the same time, however, $\frac{L}{D}$ decreases and it is necessary to refer to the example to decide if an increase in range can be obtained by this means. The calculated results, plotted in Fig. 4, show that with a following wind little advantage can be gained by increasing incidence, but with a head wind of 60 ft./sec. the range can be increased one mile by flying about 9 m.p.h. faster.

The effect of lowering the flaps has now to be considered. From Fig. 2, it is apparent that, for small values of C_L, $\frac{L}{D}$ is decreased by lowering flaps. However, at larger values of C_L the opposite is the case, but within the normal flying range no further advantage can be gained by lowering the flaps more than 5 deg.

Fig. 4 shows that with the flaps lowered 5 deg. maximum range is decreased for all wind conditions. It should be noted that these results apply to an aircraft having slotted flaps. Split flaps do not give so high $\frac{L}{D}$ ratios and hence the range would be even further reduced by them.

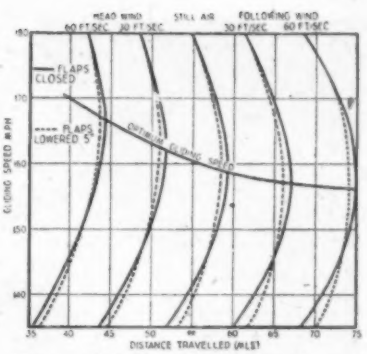


Fig. 4. Effect of gliding speed on distance travelled.

To conclude, these results may be briefly summarised as follows. In the case of an aircraft gliding in still air, maximum range is obtained at max. $\frac{L}{D}$ and is independent of weight. With a following wind a slight increase in range can be obtained by jettisoning weight and also by a small decrease in gliding speed. With a head wind it is disadvantageous to jettison weight, but a limited increase in speed will extend the range. In all cases it is of no advantage to lower flaps.

From the practical point of view it is as well to note that these increases in range are relatively small, though in certain cases an additional mile may make all the difference between reaching land or "ditching."

HIGH COMMAND CHANGES

THE retirement of Air Chief Marshal Sir Philip Joubert de la Ferté, K.C.B., C.M.G., D.S.O., is announced, though (like Sir Arthur Longmore) he has patriotically agreed to be re-employed in the lower rank of Air Marshal.

Sir Philip has had a very distinguished career. Originally an officer of the Royal Artillery, he learnt to fly in 1912, and went to France in 1914 as a Captain and flight commander in No. 3 Squadron. He held many appointments during the first world war, including the command of all the R.F.C. in Italy in 1918. In 1920 he passed through the Army Staff College at Camberley. Later he was an instructor at the Imperial Defence College, and in 1930 he became commandant of the R.A.F. Staff College at Andover. In the days of the Command known as Air Defence of Great Britain he was one of the early A.O.C.s, Fighting Area, and his skill as a pilot aroused the admiration of his officers, for few Air Vice-Marshals habitually flew as he did.

When the present war broke out Sir Philip was commanding the Air Force in India, but was soon recalled to a special appointment in Great Britain. Then he was made A.O.C.-in-C., Coastal Command, undoubtedly one of the most important posts held by any officer of the United Nations. Last year he was succeeded by Air Marshal J. C. Slessor and was made Inspector General of the Royal Air Force. In view of Sir Philip's experience of India, it would not be surprising if his great abilities were used again in that country.

The retirement of another very distinguished officer is announced, Air Vice-Marshal Sir Christopher Brand, K.B.E., D.S.O., M.C., D.F.C. A South African by birth, Sir Christopher was a very distinguished air fighter in the last war, having won practically every distinction for gallantry short of the Victoria Cross. His knighthood was granted for having shared with Sir Pierre Van Rynefeld the distinction of making the first flight from Great Britain to the Union of South Africa in 1920.

NATIONALISATION OF INDUSTRY

SIR FREDERICK HANDLEY PAGE, speaking at a luncheon given by the Ernest Turner Group of companies the other day, touched on the possibility of nationalised industry in the post-war era. At the moment the Government is the main, often the only, purchaser of the country's industrial output, and Sir Frederick foresaw the difficulties which were bound to emerge when the change-over came from Government to private purchase.

Sir Frederick said he was prepared to accept at once nationalisation of industry if it was to be of real benefit, but he was of the opinion that no nationalised industry can produce either as cheaply or as efficiently as one run by private enterprise; in fact, without private enterprise we should become as dull and soulless as a Government department of long standing.

Mr. Alan Turner, Chairman of the Group, mentioned the existence of the British Colour Council, which, he said, were on the eve of releasing a "startling development" regarding the planning and décor of civil aircraft interiors.

The B.C.C. has been in existence for some little time, and although the Americans were sufficiently shrewd and wide-awake to make use of the council's recommendations, British concerns would have nothing to do with it. Mr. Turner said that it was generally agreed the Americans were five years ahead of us (Sir F. Handley Page said "No!"), but, nevertheless, there were hopes and signs that we should not allow this state of affairs to continue in the future as it had done in the past.

A.T.A. BENEVOLENT FUND

OVER £11,175 has now been subscribed to the above fund, and a list of recent donations to November 30th is given below:—

Already acknowledged	£8,388	8	1
Subscriptions by members of A.T.A. and B.O.A.C.	2,775	17	7
Payne and Griffiths, Ltd.	1	1	0
Employees of Blackburn Aircraft Co., Ltd.	1	17	0
H. D. Jordan		15	0
Inspection Dept., R.N.A.S., Donibristle	5	0	0
F. K. Hollywood	3	3	0
	£11,176	1	8

Russian Lan

The Dynamic Aircraft Industry : Growing Production : New Developments

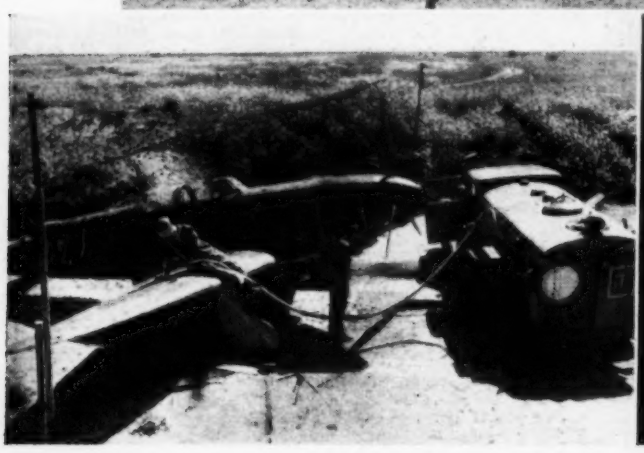
A RUSSIAN description of an aircraft factory gave the following striking picture: "The façades of the building were not quite finished, but inside the shops there were 40,000 hands already at work. The shops themselves have glass roofs and are flooded with light. They are so large that it took us several hours before we reached the last shop, where planes were ready to take-off." These giant plants, dispersed in the steppes of Russia, are the source of strength of the Russian Air Force. Remote from the dangers of the fighting zone, they could not only continue their production but, in fact, increase it, while the western industrial regions of Russia turned into a battlefield.

Marshal Stalin revealed in Teheran that Russia's monthly production is about 3,000 aircraft. A remarkable achievement for a country which lost its most important and old-established industrial regions. There is little doubt that such plants as described above are responsible for the major share of this output.

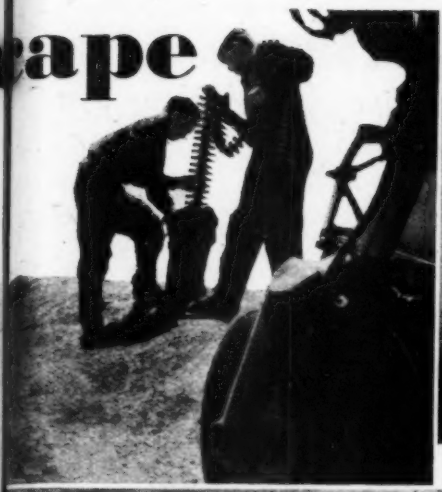
At this decisive stage of the war the situation is therefore this: The *Luftwaffe* is stretched to a maximum, and has its production resources relentlessly hammered by Allied bombers; and while its strength is still considerable on the Russian front it has to look out what the next move of the Allies will bring and to keep reserves to this end; the Russian Air Force does not only have the benefit of a rising production, of Allied supplies, of readily available fuel, but what is equally important, of continuously improving types of operational aircraft.

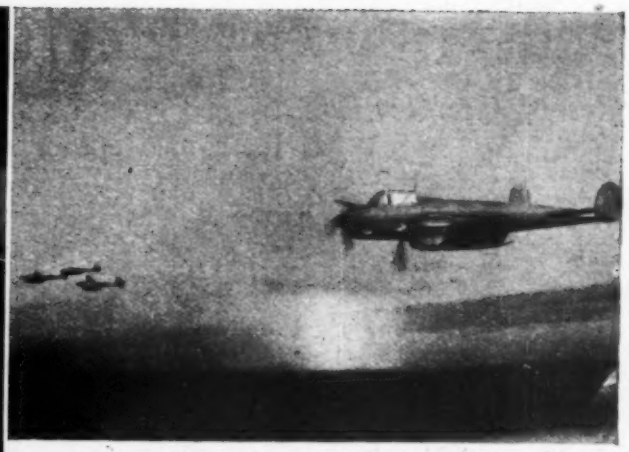
The representative types of this development are shown on these pages. The Yak-9 single-seater is another creation of the famous Russian designer Yakovlev, whose Yak-1, powered with a M-105R engine of 1,100 h.p., had a speed of 335 m.p.h. The new version has a speed of 350 m.p.h.

Referred to in enemy reports as one of the best Russian-produced aircraft is the PE-2, a medium-level reconnaissance and dive-bomber, designed by Petlyakov. This aircraft, which



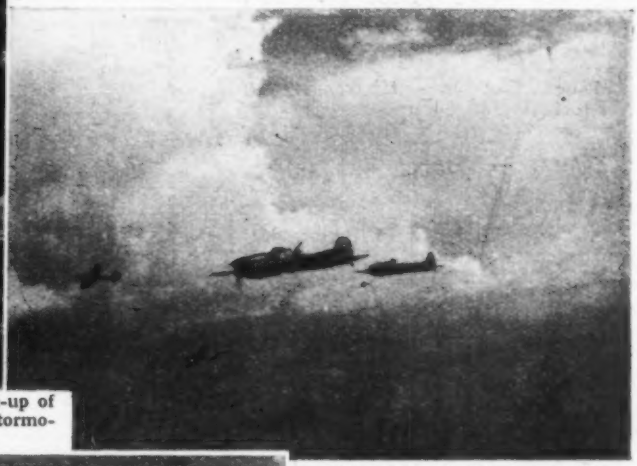
(Top) Field maintenance on the front. (Centre) The machine that won German admiration, the PE-2. (Bottom left) The Yak-9 single-seater fighter, with a 1,100 h.p. M-105R engine, has a maximum speed of 350 m.p.h. and is armed with a cannon and two M.Gs. Approximate span is 36ft. and length 30ft. (Bottom right) Fraternal partnership: the two Glinka brothers (not to be confused with the Russian composer) brought down between them forty German aircraft.





(Above left) Ground crews work at high speed to keep the machines in the air. (Above right) The PE-2 reconnaissance and dive-bomber, powered with two 1,100 h.p. M-103 engines, has a maximum speed of 335 m.p.h. at 16,400ft. and a diving speed of 405 m.p.h.

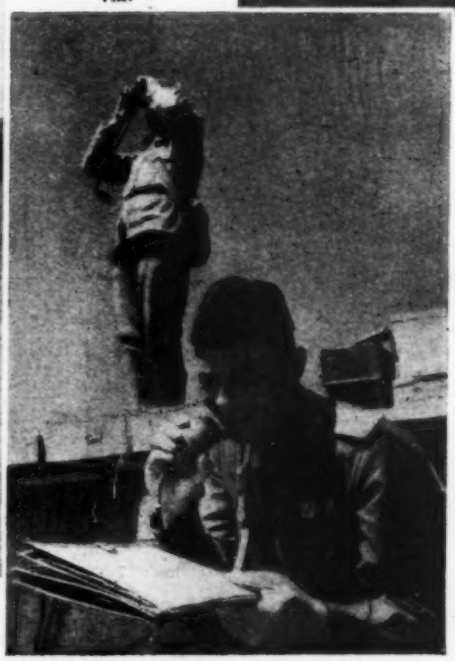
(Above) A close-up of the famous "Stormovik."



(Above) A unit of the PE-2s. The machines are armed with three rigid and three flexible M.Gs.

(Below) Lt. Col. Grabaretz, commander of a fighter unit whose pilots accounted for 120 Huns in the Kuban battles.

(Above) Russian pilots returning from an engagement. The flame dampers on the Yak-9 would indicate that they are also used for night fighting.



has been in service in all sectors of the Russian front, carries a crew of three and a 2,200 lb. bomb load. The PE-2, which has a maximum speed of 335 m.p.h., is already superseded by a still later version, the PE-3.

Another well-known type is the IL-2 "Stormovik" (a generic Russian term for assault aircraft), which is powered with a 1,300 h.p. M-38, and carries eight rocket bombs. Strongly armoured, this aircraft has wrought havoc among German armoured divisions, and is the most widely employed Russian tank-buster.

This is by no means a complete list of new equipment produced for the Russian Air Force. While it gives an indication of aircraft in wide operational employment, it is well to remember that new aircraft types are constantly coming off the production lines.

Engine Cowlings

Examples of German Power-egg Practice : Clean Exteriors Combined With Ease of Replacement

THESE notes, prepared by the Ministry of Aircraft Production, describe the arrangement of the engine cowlings on certain types of German aircraft. In each case the cowling is attached directly to the engine and not to the fuselage, so that the engine can be removed complete with its cowling. The arrangement enables the engine to vibrate on its rubber mountings relative to the fuselage without any risk of distortion of the cowling. These cowlings all appear to be designed to facilitate rapid removal and replacement and to have the cleanest possible form when assembled.

Me. 109F Engine Cowling.—This is a fighter fitted with a D.B.601E 12-cylinder inverted V liquid-cooled engine, the radiators being below the wings and the oil cooler below the engine. On each side of the crankcase are two brackets which are bolted through rubber pads to a pair of triangular magnesium forged bearers, as shown in Fig. 1.

Vibrational Freedom

The engine is therefore free to vibrate relative to the bearers. The cowling is attached to the exhaust manifold shroud, and is in three main parts of which the lowest actually carries the oil radiator. Behind the spinner is a ring consisting of an upper and a lower section, shown in Fig. 2. The lower section is attached by two screws to the front of each exhaust shroud and the upper section is fitted to it by a pin and socket and a toggle fastener at each side. Each half of this ring is stiffened by circumferentially disposed hat sections and small angles at the edges where

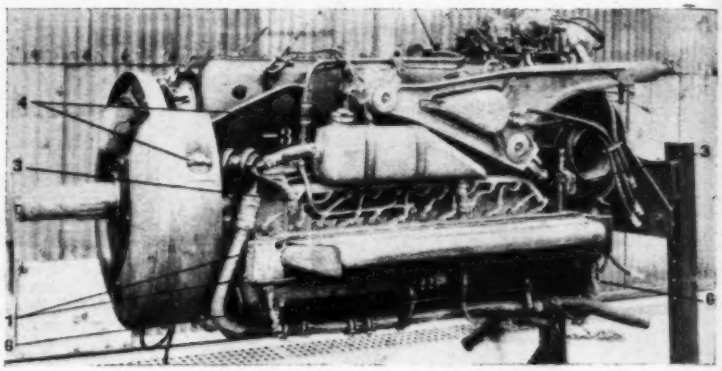


Fig. 1. The D.B.601 engine of the Me 109F from the port side. Cowling removed to show supports, etc.

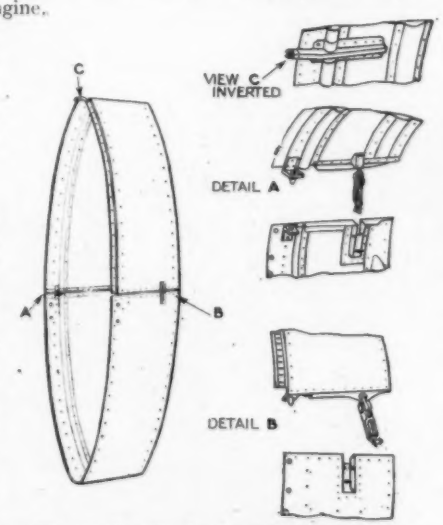


Fig. 2. Details of nose cowling of D.B.601 in Me 109F.

the two sections of the ring meet.

The upper part of the engine is enclosed by a large bonnet (Fig. 3), hinged at the centre, the hinge being attached to a stay formed of two 1in. angles riveted together. This stay is connected by a pin at its forward end to the front ring, as shown at C in Fig. 2. The bonnet has 2½in. by ¾in. square hat sections, 9, along its lower edges and 2in. by ¾in. hat sections, 10, round the front and rear edges, and is further stiffened by two circumferential and two longitudinal hat sections and by the channels for the two M.G.17s. At its rear edge is a rubber strip, 11, which makes a flexible seal with the fuselage. On the port side is the supercharger air intake duct, 12, and a small door giving access to the coolant tank filler.

Toggle Fasteners

The bonnet is secured to the top of the exhaust manifold shroud by a pair of toggle fasteners, 2, at each side, which engage with brackets, 3, mounted on the top of the shroud and braced to the crankcase. Below the engine is a section of cowling, shown in Fig. 5, carrying the oil cooler. This is attached to the bottom of the starboard exhaust shroud by a skewered hinge, and drawn up by a pair of toggle fasteners, 6, on the port side. There are small angles along the side edges and longitudinal and transverse hat section stiffeners. The pipes for circulating oil through the cooler, and those for the hydraulic servo of the regulating flap, are all flexible, and are fitted on the starboard side so that this part of the cowling can be swung down to gain access

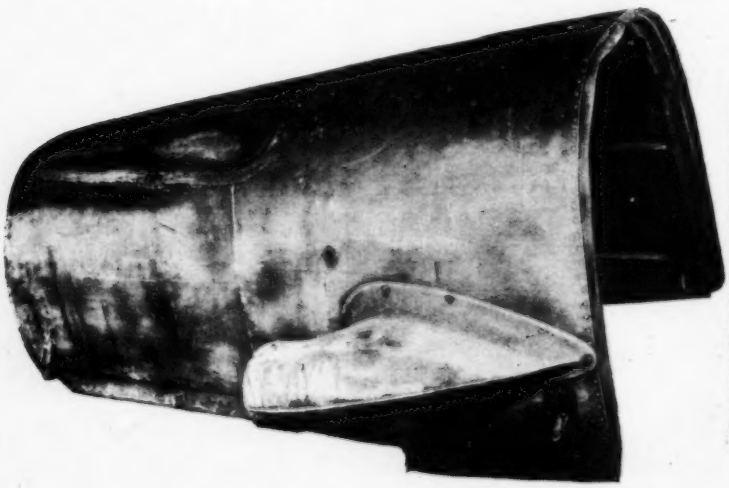
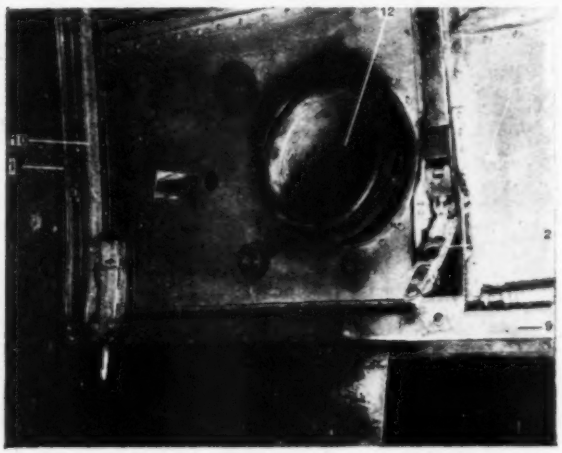


Fig. 3. Top half of Me 109F cowling. The air intake is integral with the cowling.

ENGINE COWLINGS



to the auxiliaries mounted between the cylinder blocks by merely unfastening the two fasteners, 6.

The small section of cowling over the breeches of the M.G.17s at the base of the windscreen is located by pins and sockets and held down by a toggle fastener at each side. All these fastenings are on the fuselage and the panel may be considered as a detachable fuselage covering. The skin plating of the cowling is about 20 gauge and the bonnet over the engine weighs about 1.37 lb./sq ft.

Do 217 Engine Cowling.—This machine has two B.M.W.-

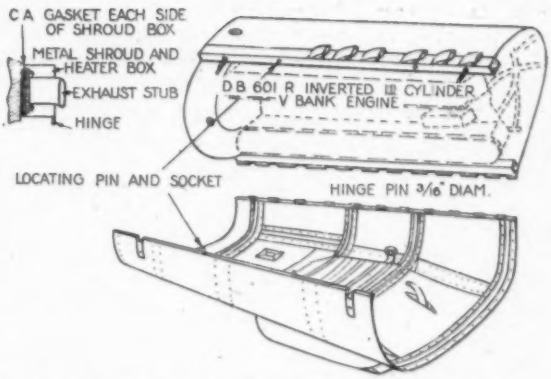
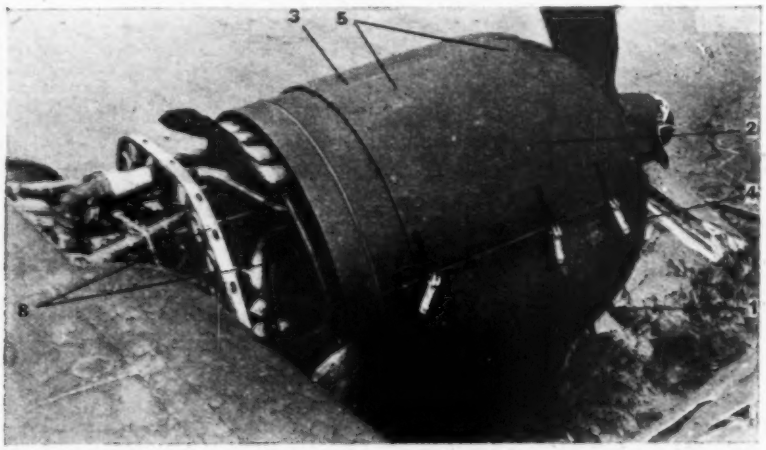
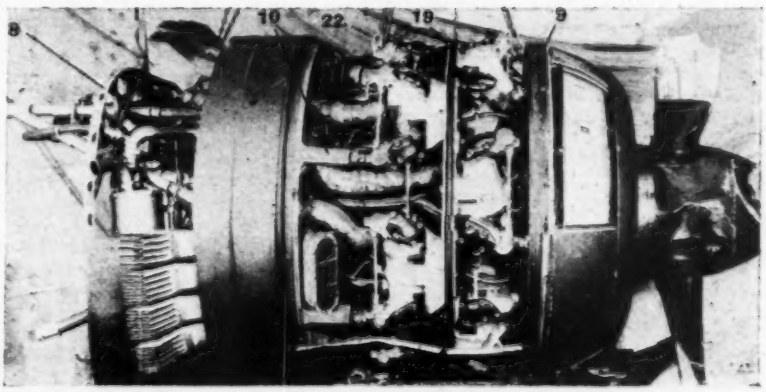

C A GASKET EACH SIDE OF SHROUD BOX
METAL SHROUD AND HEATER BOX
EXHAUST STUB
HINGE
DB 601 R INVERTED 12 CYLINDER V BANK ENGINE
LOCATING PIN AND SOCKET
HINGE PIN 3/16" DIAM.

Fig. 4 (left). End of intake duct on inside of cowling.
Fig. 5 (above). An underneath view of the Me 109F cowling.

801A 14-cylinder two-row radial engines in underslung nacelles. The flow of cooling air is assisted by a fan and controlled by a sliding gill, operated by an electric motor and screw jack. A similar sliding gill at the front of the engine controls the air flow through the oil cooler. The front assembly, consisting of the sliding gill ring and oil cooler, is attached by pin joints, 9, to the rocker covers of the front row of cylinders. The assembly containing the rear sliding gill ring has brackets, 10, whose ends are secured by pin joints to the rocker covers of the rear row of cylinders. The space between these rings is covered by a readily detachable cowling in four pieces. The engine can be removed from the aircraft as a unit complete with these cowlings, and can vibrate relative to the airframe, since it is mounted in rubber bushes and all the connections are flexible.

The three groups of exhaust pipes pass out behind the rear sliding gill and are supported by brackets attached to the engine side of the flexible mountings.





Figs. 6 and 7. One of the B.M.W.801 engines, cowled and uncowled, of a Dornier Do 217.

Car Bonnet Practice

The cowling between the front and rear ring assemblies of the engine consists of two side sections, 1, which are pressed out locally to form "blisters" which enclose the air intake ducts for the supercharger. Each piece has two lugs at its forward edge which engage with slots in the forward ring assembly, and two spring-loaded bolts at the rear which engage with the rear ring assembly. At the top and bottom of the engine are portions of the "motor car bonnet" type, each consisting of two leaves, 2, hinged to a narrow centre strip, 3, which is secured by a lug at its forward end engaging with a slot in the front ring and a spring bolt at the rear, as in the case of the side pieces. The leaves, 2, are drawn against the sections, 1, by toggle fasteners, 4, of the type already described.

The leaves of the upper cowling are supported when open by props having a ball joint at one end and a ring at the other, which is slipped over a peg; when not in use these props are clipped inside the leaf.

An air seal runs right round the

ENGINE COWLINGS

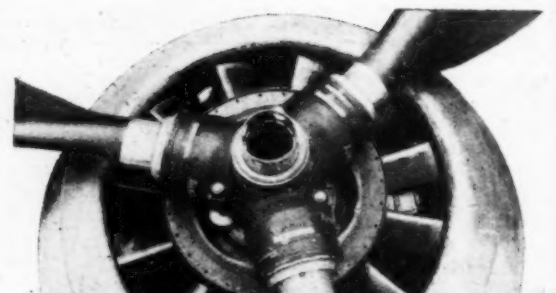


Fig. 8 (above). Dimensions of cowling of B.M.W.801 engine in Do 217. In the area of cylinder cooling exit the area of exhaust pipes has been deducted. On the right (Fig. 9), front view of Fw 190 cowling in place on aircraft. The cooling fan should be noted.

cowling between the two rows of cylinders. This consists of a rubber ring, 19, passing round the engine and resting in a depression formed on the tops of the cylinder baffle plates. A circumferential rib runs round the inside of each section, and acts as a stiffener and is pressed against this rubber when the cowling is closed, thus forming the seal. The sections of cowling are further stiffened by 2½in. × 1in. hat sections at their front and rear edges, and by 1in. × 1in. angles along their longitudinal edges, and in the case of the sections, 1, by the air intake ducts. The skin is of about 20 gauge light alloy sheet. Each leaf of the upper pair has two small doors, 5, near the hinge which give access to the lifting rings bolted to the rocker covers, thus enabling the engines to be removed without opening or removing the cowling.

Behind the exhaust is a section of cowling attached to the nacelle, consisting of a number of sector-shaped plates secured by spring fasteners to a pair of pressed angle rings, 8, fitted to the steel tubular engine mounting. This section is completed by a fairing forming part of the leading-edge of the wing and attached by spring-loaded bolts.

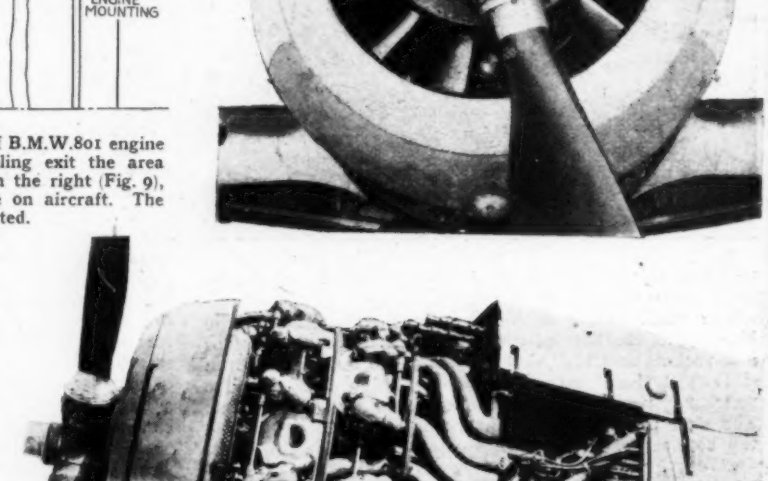


Fig. 10. Port side view of Fw engine with cowling removed.

Fw 190 *Engine Cowling.*—The Fw 190 fighter is fitted with a B.M.W. 801D 14-cylinder two-row radial engine with fan-assisted cooling, but no adjustments are provided for the air flow or oil cooling. The cowling consists of two parts, the front part attached to the engine and able to move with it on its flexible mountings (and to remain in place when the engine is removed from the airframe), and the rear part which is attached to the fuselage.

Armoured Oil Reservoir

At the front, surrounding the fan, is a casing consisting of two rings of 5 mm. and 3 mm. armour respectively, containing the oil reservoir and cooler. This casing is attached by ball joints to the rocker covers of the forward row of cylinders. Bolted to the rocker covers of the rear row of cylinders are a number of rubber-faced sectors which, together with a beading at the rear edge of the front casing, form the supports on to which the main cowling is drawn round the cylinders.

A small portion of the cowling is attached by skewered hinges to the upper and lower side leaves, the skewers passing through eyes in two brackets attached to the rocker covers. The lower pair of the sections fold inward and their edges are drawn together by toggle fasteners. The upper pair of leaves are secured by the same type of fasteners to the top position of the cowling. The top section has channels for the M.G. 17s and is attached to the engine by the loops on its underside, which fit over prongs on a bracket and by a latch which engages under the armour ring.

A rubber sealing ring runs right round the engine between the two rows of cylinders, as in the 801A. A channel section rib runs round inside each portion of the cowling and presses against this seal when it is closed. Inherent stiffening is provided in the case of the top section by the gun channels and angles at the side edges; on the panels by support from the supercharger air intakes which are enclosed within the blisters, and in the case of other panels by angles at the longitudinal edges, a 4in. × 1½in. hat section at the leading-edge, and a dimpled double skin at the rear. The skin is of about 20 gauge and the weight of the cowling around the cylinders is 1.92 lb./sq. ft. The engine cowling assembly with the oil tank empty weighs 252 lb.

The part of the cowling attached to the fuselage consists of three pieces and encloses the engine mounting and the

(Continued at foot of page 675.)

Short-course Cadet

The University Experiences of an A.T.C. Corporal

By G. PAUL CLIFTON.

COURSES for cadets were held at a number of Universities, and although cadets could express a preference for a particular University there was no guarantee that they would be sent there. I wanted to take a degree course after the war, and had gained admission to a college. Luckily I was allocated there under the Short-course scheme. Cadets were chosen for admission to the course by interviews with special R.A.F. Boards, and applicants were nominated by headmasters. The qualification required was School Certificate or its equivalent. I had the A.T.C. Proficiency Certificate Part 1 in addition to School Certificate, and also I was a corporal in the A.T.C. These qualifications were a great advantage when I had my interview. A number of A.T.C. cadets who did not have School Certificate were recommended as candidates by their A.T.C. squadron-commanders, and then were admitted to the course by a special R.A.F. examination and an interview.

The main reason why cadets were sent to the University for six months was that, by supplementing their normal Service training, the college life and work improved their education and matured their minds and personalities to make them better officers.

Democratic Spirit

All social types and classes were represented among members of the course, and the democratic spirit of the cadets struck me forcibly. All cadets were about eighteen years old, and the majority came straight from school, mostly from the bigger Public and Secondary Schools, but some cadets were ex-elementary schoolboys. All members of the course had the same opportunities, and all were judged by the same standards. Ability was the sole qualification for success. Everyone was keenly interested in the work, there was a friendly competitive spirit, and the average marks obtained were high.

Our programme on the course was divided into two parts: (i) R.A.F. work, and (ii) University work. All members of the course were enrolled in the University Air Squadron, and we received our R.A.F. training there. For two days a week we did air crew training, and covered the R.A.F. Initial Training Wing syllabus during our six months' course. Subjects of instruction included Navigation, Law and Hygiene, Signals, Elementary Mathematics, and Principles of Flight. Most of our training was done on the ground, but we had occasional flights in Tiger Moth trainers, and I flew twice while in the Air Squadron.

Although we were not guaranteed commissions because we were on the course, we had special training to suit us for commissions and were treated as potential officers. We had our own cadet N.C.O.s and officers chosen from cadets, and everyone had an equal opportunity to show that he had powers of leadership and could assume positions of responsibility. A cadet could hold any rank from Flight Sergeant to Wing Commander, and ranks were changed each week to give everyone an equal chance. We used the same mess as our officers.

Guest Nights

Cadets were assessed for recommendation for commissions on their progress and conduct throughout the course, and special credit was given for qualities of leadership; initiative; intelligence, including examination results; smartness and neatness of appearance; keenness; and general efficiency. Progress both in R.A.F. and University work including sport and other activities, was taken into consideration. We had interviews with the C.O. at the beginning, middle, and end of the course, when our progress was reviewed thoroughly.

"Guest Night" was a big occasion for every cadet on the course, for then the officers in the Air Squadron entertained us to dinner and a party. The evening started in formal style, but the atmosphere changed later. We had a hectic Rugger scrum and then did the "blanket ceremony," in which as many people as possible were bumped to the ceiling in a blanket.

R.A.F. training occupied two days a week, and we spent the rest of each week on University work, living as ordinary undergraduates. We had rooms in college, and did University studies. Within limits, cadets could read whatever college subjects they chose, and these included Science, Modern Languages, and Law. All cadets attended Physical Geography lectures for instruction in Meteorology. I read Modern History as my main subject, and the lectures were intended to give cadets a better understanding of present-day topics. Like most students, I joined several University societies, including the Union Society and the one for International Affairs. Everyone did plenty of sport; swimming, squash, and especially rowing. I rowed bow in my college eight, and often we were up at 6.30 in the mornings for rowing practice. On the first day of the "Bumps," the University rowing races, our bows passed the cox of the boat in front after we had rowed only 500 yards.

SQUADRON LEADER "SNOW WHITE," R.A.A.F.

THE only female squadron leader flying in the Royal Australian Air Force in the United Kingdom is Sqn. Ldr. Snow White, who was recently awarded the D.F.C. by fellow-members of her crew after a trip to Berlin.

Sqn. Ldr. Snow White, a year-old white pigeon with brown patches, has been out with the Lancasters on about 100 operations. She has a daughter coming up through the ranks.

Included in Snow White's "tour" with her present crew are two journeys to Hamburg, the Berlin trip, five to the Ruhr, and twice to Milan. Snow White, of course, is only one of the thousands of pigeons doing a war job these days, risking life and wing sometimes to bring home an S.O.S. from airmen in difficulties. More than one of them has been a casualty and some bear the weals of wounds inflicted on them in flight and stitched up afterwards by the medical staff.

Some pigeons doing this kind of war work have been known to fly at the rate of more than 2,000 yards a minute. In suitable weather they can fly 200 miles, and have been known to keep flying for 15 hours.

The airmen who look after them are mustered as "Pigeoneers," and were pigeon fanciers in peacetime. One of the men sleeps close to the birds each night; most stations have a pigeon corporal and three pigeon aircraftmen, with a pigeon sergeant to make periodical inspections within his circuit.

The containers in which pigeons are carried in aircraft are made of light metal, are buoyant, and can be made watertight. They are painted yellow, with a breather cap covered with red luminous paint, and are lined with absorbent material to soak up water if the aircraft has to be "ditched."

ENGINE COWLINGS (*Continued from page 674*)

M.G. 17s. The two side doors are hinged at the wing roots and have large louvres through which air escapes to form a "blanket" under the exhaust gases. They have latches at their rear edges and close against brackets attached to the fuselage side of the mounting ring, and are stiffened by vertical hat sections between the louvres. Over the guns is a bonnet hinged to the base of the windscreen, which folds down on to brackets and is secured by three toggle fasteners on each side, one mounted on the fixed panelling and two on the side door. It has a dimpled double skin.

Topics of the Day

Disciplined Freedom

The Present Flying Control System in Peace : Trusting the Man on the Ground : Discipline Without Unnecessary Restriction : Some Suggestions for Controlling the Amateur

ONE of the many good things this war has produced is a really cut-and-dried flying control system in the Service. Gone are the days when one went round a strange grass airfield searching for a windsock, and finally came in to land with eyes popping out like organ stops and one's neck aching from the wild efforts to make sure that some other aircraft wasn't serenely flying below or above one's own—and converging on the same patch of turf.

The new system has, of course, been helped immensely by the now almost universal use of runways, but the focal point of success has been the man with the Aldis light beside the little chequered box. He's not always well trained and intelligent, of course—trainees must start somewhere—but the standard is steadily going up, and it is a rare thing nowadays to find oneself at zero feet, and almost at the stall, with some other aircraft within ten feet of one's nose. The controller will usually have given either you or the other pilot a red light—and, maybe, if one is flying a big machine, or one that he has seen "going round" several times, a green light as well—in good time for final decisions.

Order of Precedence

With the varying degrees of vision from the pilot's seat of different machines, one *can* only trust the man with the lamp. Whatever his ideas, you know quite well that he can see the whole sky while you can only see some of the sky straight ahead. At the worst he will do his best to sort you all out even if you have to go round again half a dozen times; at the best he will eye you intelligently in the distance and decide whether yours is the type of machine which should have preferential treatment. A four-engined device, for instance, in which the "overshoot" operations are ponderous and complicated even with the assistance of a flight engineer will be given preference, if possible, over anything else. The same will apply to something like a Mosquito with no very complicated operations involved, but with a high approach speed and a comparatively slow acceleration from the near-stall when everything is down and ready for the landing.

A visitor at a training airfield, unless he is flying a very simple aircraft, will be given preference over all the unfortunate pupils and instructors—both on the score of politeness and because the visitor may not be familiar with the field. Anyway, it is considered a few "reds" will give the pupils some very necessary "overshoot" practice!

And at the back of it all only one thing makes the system finally workable—discipline. Pilots who ignore "reds" have their numbers taken and must give a very satisfactory answer to the F.C.O. or C.F.I. if he is to be saved from the mat in the Station Commander's office. For those who are outside Air Force discipline, other measures can be taken but, in general, there is absolutely no need to show the iron hand in the velvet glove. Common sense will tell the stupidest person not only that the controller, so to speak, is the only person who "sees all and forgives all," but that some rules must always be kept for the benefit of the majority. Otherwise there would not be any sense in anything.

The question is: What will happen in peacetime if and when there are thousands of private aircraft blackening the sky? The transport people will be safe enough, since their jobs depend on their good behaviour and the lives of their passengers depend on good flying discipline. In the days of the last peace the transport centres had better, more clearly defined, and more thoroughly followed air traffic rules than the Air Force ever needed in their small strength. So the airline people can be forgotten in the knowledge that they will get on with it in the usual way and with all the plain sense generally shown by the transport companies—if not always by the departments controlling them.

Private Owners

So long as the imaginary and always dashing private pilots are operating from the same centres, all will be well. There is something rather forbidding about a serious airport, and, anyway, a licence can be taken away and an aircraft grounded without much difficulty if a pilot is stupid enough to stage a "shoot-up" or to organise a pretty side-slip landing slap in the path of the approaching Moscow-London transport. Even at Croydon, in the old days, we small fry used to break our hearts doing power approaches from enormous distances so that nobody should be incommoded, and so that our approach should be in keeping with the dignified traditions of that strange airline centre. A centre where bits were slowly added to bits, and where the tarmac apron—almost a medieval word now—spread remorselessly year by year out towards the middle of the field and formed, at its edge, an unexpected new hazard for skidding aircraft with weak underparts.

But what form of general flying control can there be for private owners working from their own fields or from club fields? Obviously, the same sort of arrangements must be made, and the rules must, so far as possible, be kept. Where airfield safety control is concerned 99 per cent. of the pilots will have the sense to keep them, but it will be difficult to deal with hundreds of radioless aircraft which are wandering about the country in bad weather. One can only hope that only *sensible* rules are made, and that the authorities do not try to introduce all kinds of regulations which will make it quite impossible for the owner or club pilot to carry on at all.

Corridors and Congestion

There must, of course, be corridors in very congested areas—just as there are corridors at the present time for entering and leaving defended and other areas—but, in general, there seems to be no very good reason why there should be serious restrictions in other parts of the country, or why the ether (or whatever) should be made hellish by the out-of-tune cries of lost or merely talkative pilots. In any case, plain technical difficulties will

DISCIPLINED FREEDOM

probably prevent the extensive use of radio telephony by all and sundry.

Every airfield, however, might have a beacon of fixed frequency, and every aircraft, at the cost of only a hundred pounds or so, could be fitted with a reliable homing receiver of the same pattern. Provided that he knows approximately where he is, the private pilot will be able to tune in to the necessary fixed frequency and get himself either to the nearest landing ground or to the one he actually requires. Once he has sighted the field his movements will be taken over by the airfield controller.

Signals

If, because of the presence of other traffic, the A.C. requires him to "orbit" the place, or even to go back on a reciprocal, as the case may be, it will be easy enough to tell him so visually. It may even, by using a set number of flashes, say how long he will have to wait. There will be no real difficulty about anything of that sort so long an everyone knows and keeps the rules.

As for the dangers of collision with "all the aircraft likely to be in the sky," I simply do not believe there *will* be so many for a very great number of years. Certainly there are not likely to be more in the sky than there are at present by day or by night, and present conditions have not yet demanded the application or even much more than the suggestion of rigorous special rules. Daylight aircraft fly more or less where they wish and how they wish. Until one reaches the vicinity of a busy airfield, the dangers of collision, even in conditions of poor visibility, are very small, and can be happily taken by anyone who is prepared, for instance, to cross a peacetime London street.

It will probably be necessary, as I've said before, to do something about the busy environs of airfields, simply because everybody tends to do a circuit at much the same height, and the final approach is certainly a dangerous moment. At present, in war, the risk is taken cheerfully enough, but even slight risks, if they can be avoided, are not accepted in times when everyone expects, if not hopes, to die in his or her bed. It would be possible, for instance, to arrange that new arrivals in a circuit stay so far out until recalled by a signal from the control tower, after which each pilot, in his turn, would be told when to start his final circuit, receiving a confirmatory "green" as he turns in to land. That's just an idea. It has not, except at night, been found necessary so far, even at training centres, but, as I say, peacetime people are a great deal more squeamish than those living in the middle of a major war.

At any rate, it is all going to be extremely interesting, and there is absolutely no reason why some necessary degree of discipline should not be maintained, or why not too complicated plans should not be formulated for special conditions. *And* without making the private owner's or club pilot's life in the air quite impossible. There is no reason why it should be made so unless bureaucracy, run, perhaps, by somewhat livery very-ex-flying people, is allowed to run wild.

"INDICATOR."

NEW POST FOR "BUKE"

PROBABLY it will have been as much of a surprise to his innumerable friends in the aircraft industry and Ministries as it was to us to learn that Major J. S. Buchanan has reached his 60th birthday. At the same time as wishing him "Many Happy Returns," we congratulate him on his appointment to the post of Assistant Chief Executive at the Ministry of Aircraft Production, where he will be "Number Two" to Sir Wilfrid Freeman.

Major J. S. Buchanan.

His previous post of Executive Officer of Production Efficiency has been filled by Mr. J. W. Mills, Chief Superintendent of Technical Costs.

We wish "Buke" all good fortune in his new post. After his many years of hard and worrying work, especially as Deputy Director of Technical Development, he deserved a post in which he will not be quite so harassed by the need for difficult decisions on technical details. May he continue to be a valued and trusted counsellor and friend to the aircraft industry for many years to come.

SUPERFUEL NOW AVAILABLE

PERFECTION of a process which makes possible the production of triptane on a commercial scale to sell at less than $1 (5s.) per U.S. gallon has been reported by Dr. Gustav Egloff, a Standard Oil research chemist and president of the American Institute of Chemistry, at a conference of the National Association of Manufacturers held in San Francisco, California, to discuss post-war problems.

Triptane is a hydrocarbon superfuel which has such a high anti-knock property that no engine now commercially built can withstand the full pressure generated by its combustion when used alone, according to the speaker. But when used as a component of aviation petrol, he said, it greatly enhances the performance of present aircraft engines and can give warplanes of the Allied Nations a superiority in speed, climb and lift which "would put enemy planes as much at their mercy as if they were roosting pigeons." It can raise the power half as high again as if the engines were burning 100-octane petrol.

This report was said to be the first public announcement of the process, which was developed by Dr. Vladimir Haensel and Prof. Vladimir N. Ipatieff, research chemists of the Universal Oil Products Co. They had had a pilot plant in continuous producing operation for more than a week at the time of the conference. The process and the equipment required for it were not described, however, for a very obvious reason.

"MET" CHAIN TO AID EMPIRE FLYING

A CHAIN of magnetic stations and meteorological observatories throughout the Colonies as aids to air and sea navigation, wireless transmission, agriculture and mining, are envisaged in the first progress report of the Colonial Research Committee, published recently as a White Paper.

The Committee was formed in 1940, with Lord Hailey as chairman, to co-ordinate the whole range of research in the Colonial Empire.

It calls for a network of magnetic stations to provide continuous observations as a basis for navigational charts, assisting mining development, and the preparation of topographical maps. The Colonies, it says, are not at present taking their full part in what is essentially an international scientific duty.

"Meteorological observatories are also required since the rapid development of flying has added to the importance of weather knowledge and forecasts. Meteorological observations are of value to agricultural departments, and if supplemented by other geophysical measurements may be of considerable importance in the development of wireless transmission and radio navigation aids. A number of further observatories is required in the Colonies."

The Committee recommends that detailed proposals for an extension of Colonial magnetic and meteorological services should be prepared without undue delay.

A scheme is also under active consideration by the Colonial Survey and Geophysics Committee.

The report represents a first attempt to survey the whole field of Colonial research and its requirements. Among the Committee's duties is that of advising on the expenditure of money provided for research under the Colonial Development and Welfare Act.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AIRPORT DESIGN

Direction of Runways

WITH reference to your article on the designs for possible extensions to Gatwick Airport, I beg to call your attention to your criticism of the small or "local" scheme, in which you make a statement to the effect that the longest runway (in this case of 2,000 yards) should lie in the direction of the prevailing wind.

This is not necessarily the case. The provision of a long runway in an airfield design is made with the object of facilitating the operation, on windless days, of heavily laden aircraft when a much longer take-off is required.

The longest, sometimes referred to as the "windless," runway should not be confused with the main runway, which in a good design runs as near to the direction of the prevailing wind as possible, and its surface should be constructed to take a greater volume of traffic.

The "windless" and main runways in some designs may, of course, be one and the same thing. ROBERT SHORTER.

TRIMMING TABS

Diagrammatic Explanation

IF the way B, B and B sees the effect of trimming tabs were applied to the rudder itself, the aircraft would never turn, but would continue its course in a yawing attitude.

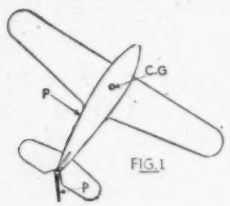


FIG. 1

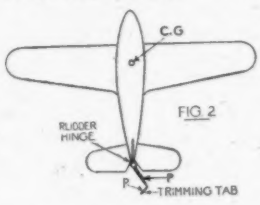


FIG. 2

Due to the fact, however, that small p (Fig. 1), which indicates the pressure of the airflow on the rudder, is a greater distance from the centre of gravity of the aircraft, and therefore has a greater leverage than large P, the aircraft continues to turn, in spite of the fact that P is tending to force the aircraft back on its original course.

The above example may be applied to the trimming tab on a rudder.

In the case of an aircraft with a tendency to turn to port, the trimming tab on the rudder is moved to port so that p, due to its greater distance from the rudder hinge, overcomes the effect of P (Fig. 2).

Thus the rudder is slightly offset to starboard, and so corrects the tendency of the aircraft to turn to port. This spares the pilot the manual effort of keeping the rudder to starboard to maintain a straight course.

I hope that this explanation will put an end to the confusion of B, B and B, and will dispel any doubt that might be harboured by others as to the way trimming tabs are set to correct a fault. "CPL. ZERO."

DAKOTA ON FLOATS

Scheme Said Not to be Successful

IT was with much interest that I read in the November 18th issue of *Flight* the article by Mr. H. W. Perry dealing with some facts and figures of the Douglas Dakota aircraft.

One point, however, seems rather ambitious—the statement made by the author that pontoons with retractable landing wheels were fitted in 1942 and that machines thus fitted were used by the American Air Transport Command in that year.

Now surely this is an error, as, according to a reliable American informant, the first C47 fitted as an amphibious transport was only being experimented with at Wright field this summer. This statement was also made in *Flight*, September 16th, 1943, and was accompanied by a photograph of the C47, plus floats, which, rather interestingly, bore the same number on the fin as the C47 shown in Mr. Perry's article, i.e., 25671.

My American source now informs me that this project is not working out too well, and there appears to be little hope of a mass-produced amphibious C47; in fact, one only exists—the original prototype. It appears that the floats were designed in an attempt to make air foils to add to the lift of the aircraft, but it seems that the lift supplied was not enough to make an appreciable difference in the extra amount of drag encountered. KENNETH S. BELCHER.

BOMBER ARMAMENT

Bullet Density is the Thing

RECENTLY you published a letter by "Young Spotter" on "Bomber Armament." It seems to me that many people think that the American 0.5in. Browning is greatly superior to the British 0.303in. Browning. I beg to differ. In my opinion, a rifle calibre m.g. is the better weapon of the two, as it has the advantages of high speed and lightness compared with the larger calibre gun.

If a larger projectile is to be fired, then a larger charge of cordite is also required, and when a larger charge of cordite is used, the barrel must be strengthened to take the strain caused by the breaking down of the propellant charge into gas to provide the motive force for the projectile. Strengthening the barrel increases the weight enormously.

In these days of high-speed fighting, planes are only in the sights for perhaps a split-second, so that a high-speed gun such as the 0.303in. Browning has the advantage of creating a high "bullet density" which the slower-firing 0.5in. gun cannot do.

From my experience, air gunners do not worry about muzzle horse-power; it is as many bullets in the target in the shortest time that counts. ROBT. G. CHORLTON
(Late Sgt. A./Gunner, R.A.F.).

AERONAUTICAL EDUCATION

Municipal Airport Requirements

THE letter in *Flight* of December 9th from Mr. R. H. Moody is of interest in connection with the post-war planning of metropolitan and municipal airports. Many post-war town planning schemes, taking into consideration the potentialities of the future development of commercial aviation, would be more likely to meet future conditions if specialists were consulted before the design and location of airports were approved.

It is agreed that the municipal airport scheme of a town will considerably influence the development of a region over a considerable period, and I therefore give my views on the six questions raised as follows:

1. The present rate of evolution of air transport will most certainly create a demand for municipal airports in most of the larger cities, towns, and industrial regions.
2. While the development of "home fuel resources" will no doubt increase, it will not be on a sufficiently large scale to supersede the large quantities of aviation spirit imported from abroad.
3. The amended designs of standard airports and their size is directly dependent upon the length of the runways required for the "take-off" of freight planes. This in turn is governed by the horse-power of the machine and the weight of freight carried.

   The development of heavily laden freight planes requiring a greater length of runway than, say, 2,000 yd. in preference to a high-power freight plane carrying the maximum commercial freight load that will enable it to utilise runways of 2,000 yd. in length is to be deprecated.
4. Heavily laden freight planes "taking off" vertically from the ground have not yet reached the stage of a payable proposition for commercial aviation.
5. This question covers the same technique that is at present used for "night flying" and flying in fog. Improvements are continually being developed for the safety of machines.
6. Air traffic, being of a special character dependent upon the speed of delivery, is not likely to compete with other means of transport where speed is not essential, and adjacent airports would have to take the necessary precautions for safety—height zoning, etc. Provided airports are kept within reasonable size, and carefully located with respect to the regions they serve, they should not interfere with the planning of towns and countryside.

W. REGINALD DAINTY.

MULTUM IN PARVO: A representative selection of aircraft types constantly in use at the Empire Central Flying School.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

New Inspector of W.A.A.F.

Wing Officer B. C. BEECROFT has been appointed Group Officer and Inspector of the W.A.A.F. to fill the vacancy caused by the promotion of Lady R. M. E. Welsh to Director of the service. As Inspector, she will see W.A.A.F. personnel on and off duty at units throughout the country. She will work in close co-operation with the director of the W.A.A.F., and copies of her reports will be submitted direct to members of the Air Council.

Promotions

GENERAL DUTIES BRANCH

Air Commodores are granted the rank of Acting Air Vice Marshal.

S. P. SIMPSON, C.B.E., M.C. September 14th, 1943.

C. B. S. SPACKMAN, D.F.C. September 15th, 1943.

Air Comdre. (temp.) A. P. M. SANDERS, C.B.E., is granted the rank of Air Comdre. (war subs.), October 21st, 1943.

TECHNICAL BRANCH

Air Vice-Marshal (temp.) R. S. AITKEN, C.B.E., M.C., A.F.C., is granted the rank of Air Comdre. (war subs.), October 24th, 1943.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Service Order

F/O. G. WILSON, D.F.C., D.F.M., R.A.F.V.R., No. 7 Sqn.—This officer and airmen were pilot, mid-upper gunner and air bomber respectively of an aircraft detailed to attack Hanover one night in September, 1943. On the run up to the target the bomber was hit by anti-aircraft fire. Four members of the crew were wounded and much essential equipment was rendered unserviceable. In spite of this, F/O. Wilson resolutely held to his course, enabling Flt. Sgt. Porteous to execute a successful bombing attack. On leaving the target, the bomber was intercepted by a fighter which attacked with great persistence. Nevertheless, F/O. Wilson succeeded in evading the fighter, being greatly assisted by Flt. Sgt. Mulholland, who kept his captain fully informed of the attacker's movements. On the return flight, Flt. Sgt. Porteous assumed the duties of navigator and executed his task with skill.

Act. Wing Cdr. R. G. ENGLAND, D.F.C., A.A.F., No. 207 Sqn.—This officer has taken part in a very large number of sorties, including attacks on important targets in Northern France. In August, 1943, Wing Cdr. England led a formation of aircraft in an attack on a target at Rennes. Bad weather was encountered on the outward flight, but Wing Cdr. England unerringly led his force to the precise target, which was successfully attacked from a low level. Some days later, this officer led a bomber force in an attack on a works at Denain. In spite of poor visibility and in the face of intense anti-aircraft fire, the objective was bombed accurately.

Act. Wing Cdr. R. H. HARRIES, D.F.C., R.A.F.V.R.—This officer is an exceptionally skilful, courageous and determined fighter. Within the past weeks he has led his fighter force on various sorties, during which 27 enemy aircraft have been shot down, three of them by his own guns. Wing Cdr. Harries has destroyed at least 15 enemy aircraft.

Bar to Distinguished Flying Cross

Flt. Lt. H. JACOBS, D.F.C., R.A.F.V.R., No. 141 Sqn.—As observer, this officer has taken part in very many operations at night and has assisted in the destruction of six enemy aircraft. He is a model of efficiency and his skilful efforts have been worthy of great praise.

Act. Flt. Lt. A. A. GLEN, D.F.C., R.A.F.V.R., No. 41 Sqn.—The officer has led his flight with exceptional skill and keenness. He is a most determined fighter, whose efforts to destroy the enemy at every opportunity have been highly commendable. Since being awarded the D.F.C., Flt. Lt. Glen has destroyed six enemy aircraft and damaged several more.

Distinguished Flying Cross

Flt. Lt. G. J. LAIRD, R.C.A.F., No. 427 (R.C.A.F.) Sqn.—For citation see Sgt. Cardy, C.G.M.

Sqn. Ldr. J. B. WRAY, R.A.F.O., No. 137 Sqn.

Act. Sqn. Ldr. N. A. KYNASTON, R.A.F.V.R., No. 91 Sqn.

F/O. M. S. ALLEN, R.A.F.V.R., No. 141 Sqn.

F/O. W. G. DODD, R.C.A.F., No. 402 (R.C.A.F.) Sqn.

P/O. J. E. MCCREA, R.A.F.V.R., No. 51 Sqn.

F/O. H. T. MOSSIP, R.C.A.F., No. 1 Sqn.

P/O. J. H. ASHTON, R.C.A.F., No. 137 Sqn.

P/O. A. B. SIMPSON, R.A.A.F., No. 467 (R.A.A.F.) Sqn.

W/O. R. C. WATTS, R.A.A.F., No. 467 (R.A.A.F.) Sqn.

Act. Sqn. Ldr. M. C. BLACK, R.A.F.V.R., No. 10 Sqn.

Flt. Lt. J. F. MCEWEN, R.A.F.V.R., No. 120 Sqn.

Act. Flt. Lt. D. W. COX, R.A.F.V.R., No. 10 Sqn.

Act. Flt. Lt. G. EDWARDS, R.A.F.V.R., No. 10 Sqn.

Conspicuous Gallantry Medal (Flying)

Sgt. W. H. CARDY, R.C.A.F., No. 427 (R.C.A.F.) Sqn.—This officer and airman were pilot and flight engineer respectively of an aircraft detailed to attack Kassel one night in October, 1943. During the operation the bomber was hit by a hail of bullets from an enemy fighter. Nevertheless, Flt. Lt. Laird coolly and skilfully outmanœuvred the enemy aircraft and set course for this country. Two of his crew had been killed, however, and Sgt. Cardy was wounded in the arm and in the eye. In spite of intense suffering, this gallant airman refused to leave his post and executed his normal duties until he finally fainted through loss of blood. Later, when he again recovered consciousness, he attempted to do as much as he could to assist his captain in the homeward flight. By a superb effort Flt. Lt. Laird succeeded in reaching base where he effected a safe landing in difficult circumstances.

Distinguished Flying Medal

Flt. Sgt. B. N. MULHOLLAND, R.A.F.V.R., and Flt. Sgt. W. F. W. PORTEOUS, R.A.F.V.R., both of No. 7 Sqn.—For citation see F/O. Wilson, D.S.O., D.F.C., D.F.M.

Sgt. R. HENDITCH, R.A.F.V.R., No. 101 Sqn.

Sgt. G. G. WHITTLE, R.A.F.V.R., No. 101 Sqn.

THE KING has been graciously pleased to approve the following awards:—

M.B.E. (Mil.)

F/O. R. J. O. DOEHLER, R.C.A.F., No. 424 (R.C.A.F.) Sqn.—One night in July the bomb load of a Wellington aircraft, which was standing in the dispersal area, detonated and the wreckage caught fire. Soon a second aircraft caught fire and its bomb load also exploded.

F/O. Doehler was proceeding to the scene immediately after the first aircraft had exploded, when the second aircraft blew up, and he was thrown to the ground. He immediately got up and went towards an aircraft which had not caught fire and taxied it to safety. Assistance to injured personnel was rendered by Flt. Lt. McCombe, an armament officer, who had, on a previous occasion, displayed great calmness in directing fire-fighting operations on an aircraft which was blazing near to a 4,000lb. bomb, and by Flt. Lt. Lindsay, a medical officer, who had previously displayed great courage in dragging the body of an air gunner from a blazing turret. Flt. Lts. McCombe and Lindsay proceeded to the first aircraft after it had exploded, and found that several airmen who had been standing under the wing had been seriously injured and burned. During their successful efforts in rescuing two airmen both officers were thrown to the ground by an explosion in the second aircraft. Flt. Lt. Lindsay then took the rescued airmen to hospital, while

his companion remained and took the remaining injured personnel into his own car. While the car was being drawn away a bomb exploded and two large fragments were hurled through the doors of the car. Flt. Lt. McCombe remained unperturbed, only thinking of the safety of those he had rescued.

Sgt. Campbell was proceeding to the scene of the first explosion when the second aircraft blew up, and he was thrown to the ground. Undaunted, he went on and helped to start the engines of a nearby bomber which had not been caught by the flames, and while this aircraft was being taxied away, he went to a second aircraft, and, after its engines had been started, assisted the pilot in negotiating obstructions while the aircraft was being taxied to safety. During this time an explosion occurred, and Sgt. Campbell was knocked down again. Still undeterred, he helped to put out fires on the runway. L.A/C. Snelling was thrown to the ground by the explosion in the second aircraft while he was proceeding to render assistance at the first aircraft when it had blown up. Regaining his feet, he ran to an aircraft which was untouched by fire and taxied it away after having started its engines himself. L.A/C. Wilkinson proceeded to the scene when he heard the first explosion, and helped a wounded man to safety. The fire had spread to the second aircraft, and, disdaining the risk of explosion of its bombs, this airman led three other men to rescue another injured man lying near the first aircraft. As the party were leading the rescued man away from the conflagration the second aircraft exploded, and all were thrown to the ground, but they were able to save their comrade, and reached safety as a third explosion occurred.

George Medal

Flt. Lt. R. J. McCOMBE, R.C.A.F., No. 331 (R.C.A.F.) Wing, and Flt. Lt. E. J. A. LINDSAY, R.C.A.F., No. 424 (R.C.A.F.) Sqn. For citation see F/O. Doehler, M.B.E.

B.E.M. (Mil.)

Sgt. J. A. CAMPBELL, R.C.A.F.; L.A/C. C. A. G. SNELLING, R.C.A.F., and L.A/C. P. P. WILKINSON, R.C.A.F., all of No. 424 (R.C.A.F.) Sqn. For citation see F/O. Doehler, M.B.E.

Roll of Honour

Casualty Communiqué No. 318.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 100 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. J. F. McK. Gunn; Sgt. F. E. Hayman; P/O. R. Hewison; Sgt. A. J. Lane; Sgt. J. D. Law; Sgt. R. Payton; W/O. P. E. G. Utton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. E. Chamberlain; Sgt. W. Woosnam.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. S. G. Adams; Sgt. G. H. Anderson; Sgt. F. H. Austin; Sgt. G. W. F. Baker; Sgt. C. E. Bellamy; Sgt. C. L. Billington; Sgt. D. Brennen; Sgt. D. Brown; P/O. E. H. Burgess, P/O. A. G. Cameron; Flt. Sgt. R. S. Carr, D.F.M.; F/O. B. Clitheroe, D.F.C.; Sgt. A. B. A. Colonna; F/O. M. E. Doble, D.F.C.; Flt. Lt. A. A. Emery, D.F.M.; Flt. Sgt. C. H. Evans; Sgt. W. Fleming; Flt. Sgt. P. Flynn; Sgt. A. Garden; Sgt. L. Gregory; Act. Sqn. Ldr. E. L. Hayward, D.F.C.; P/O. J. C. W. Hewetson; Flt. Sgt. J. S. Hill; F/O. R. B. Hope, D.F.C.; Sgt. J. Hutchinson; Sgt. D. P. Kerr; Sgt. J. H. Lightfoot; P/O. I. A. H. Linklater, D.F.M.; Sgt. R. L. Litolff; P/O. E. H. Mantle, D.F.M.; Sgt. G. S. Margetson; Sgt. D. B. Mogg; Sgt. G. Mortimore; F/O. J. Outerbridge; Flt. Lt. C. W. Parish, D.F.C.; Sgt. R. G. Pegg; Sgt. S. E. Perry; P/O. G. V. Pryor; Sgt. H. Sherratt; P/O. A. Urquhart; Sgt. J. K. B. Veal; Flt. Sgt. T. J. Walker; Sgt. R. H. Warren; Flt. Sgt. I. Wood; F/O. J. O. Young.

WOUNDED OR INJURED IN ACTION.—Sgt. J. J. Duffy; Flt. Sgt. P. F. Horton.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. W. J. Goby.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. H. Ackroyd; Sgt. W. H. Boyden; F/O. L. D. Clay; Sgt. A. N. Hodson; Sgt. A. J. Quar; Sgt. F. C. Stevens; Sgt. J. Taylor; Sgt. D. G. Wood.

MISSING.—Sgt. H. D. Bean; Sgt. W. H. B. Bilton; Sgt. A. R. Bohn; Sgt. E. J. Bream; Sgt. J. Bullock; Flt. Sgt. D. J. Burge; Sgt. R. J. Cheadle; W/O. P. F. Chesterton; Sgt. L. Cotton; Sgt. E. C. Coward; Sgt. F. G. Cowler; Sgt. D. L. Cowling; Sgt. C. E. Crisp; Sgt. J. Cross; Flt. Sgt. A. F. Cudd; Sgt. W. A. Davis; Sgt. R. P. Dean; Sgt. T. A. C. Dorn; Sgt. C. F. Dowlman; Sgt. R. J. Drinkwater; P/O. C. J. L. Dunlop; P/O. J. M. Dunlop; Sgt. H. D. Evans; Sgt. J. E. Farmer; Sgt. G. F. Fox; Sgt. T. T. B. Francis; P/O. J. H. Gillmore; Sgt. A. Girdler; P/O. H. Green; Sgt. J. Harman; Sgt. D. C. Harris; Sgt. J. B. Harrison; Sgt. W. A. Hart; Sgt. J. H. Hawkins; Sgt. S. C. H. Hearn; F/O. W. P. Hennessey; Flt. Sgt. K. Hewitson; Sgt. D. A. Hewitt; Sgt. H. Hicks; Sgt. D. S. Hirst; Sgt. V. Hirst-Gee; Sgt. F. W. Hucker; Sgt. L. E. Hughes; Sgt. A. L. Humble; Sgt. R. Hutton; Sgt. C. R. Jackson; Sgt. D. E. Jeffery; F/O. K. W. Jones; Sgt. G. E. Knight; Sgt. V. J Lander; F/O. H. McGhie; Sgt. M. J. MacRitchie; Sgt. J. B. Malcolm; Sgt. E. Milling; Sgt. V. Moore; Sgt. W. E. Mussen; Sgt. J. L. Newman; Sgt. R. Norris; Sgt. C. W. E. Palmer; Sgt. E. W. D. Parry; Sgt. L. Pelmear; Sgt. P. S. Raddall; Sgt. G. A. Sales; Sgt. R. E. W. Sams; Sgt. J. W. Satchell; Sgt. E. S. Shrimpton; Sgt. L. Smith; Sgt. E. T. Springett; P/O. W. E. Stenhouse; Sgt. G. C. Stolberg; Sgt. A. Stuart; Sgt. N. Teasdale; Sgt. R. H. Tozer; Sgt. R. V. Vandy; Sgt. C. Weddell; F/O. D. L. West; Sgt. T. J. Wilson; Sgt. J. Wright; Sgt. J. Yule.

KILLED ON ACTIVE SERVICE.—Sgt. W. B. Bain; Sqn. Ldr. S. W. Baldie; Sgt R. Cave; Sgt. D. Clayton; Sgt. L. Collis; Sgt. D. S. W. Deane; Sgt. W. G. Denyer; Sgt. W. Dowling; Sgt. C. A. Farrell; Sgt. W. D. Gibby; Sgt. K. MacKenzie; Sgt. G. Meyrick; Sgt. E. S. Smart; Sgt. R. R. Townsend; Sgt. J. Walker; Sgt. J. Whitaker; Sgt. H. J. Wolff.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. H. J. Birtwistle; L.A/C. E. W. Blanchard; L.A/C. R. S. Candy; A/C.1 H. Croft; L.A/C. D. G. Davies; Cpl. R. F. Diment; Flt. Sgt. J. A. Gore; Cpl. S. H. Hamlett; L.A/C. R. R. Kelsey; L.A/C. L. V. McArdle; W/O. H. G. Matthews; W/O. E. T. Millis; Flt. Sgt. S. Rhodes; Sgt. F. Roach; W/O. G. Roche; Sgt. W. Shirley; W/O. F. Tyler; Sgt. E. J. J. Villars; Sgt. C. F. Ward.

DIED ON ACTIVE SERVICE.—A/C.1 A. T. Bath; Cpl. R. Johnston; F/O. E. W. Mitchell; Flt. Lt. K. W. Monks; L.A/C. G. Moss; L.A/C. S. Platt; L.A/C. H. Ward.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. A. Baldwin; Sgt. H. F. Brodie; Sgt. W. A. Fairweather; Sgt. A. Giblin; Sgt. D. Lewis, Sgt. N. J. Pawley, D.F.M.; F/O. A. N. Snell.

Flt. Lt. J. A. Broadley who, at a recent investiture, received the D.S.O., D.F.C. and D.F.M.

Royal Australian Air Force

KILLED IN ACTION.—F/O. R. H. P. Tucker.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. R. Riley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. R. H. Annells; Flt. Sgt. D. C. Bell; F/O. K. J. Bennett; A/C.1 A. E. Elrick; Flt. Sgt. J. H. McCarthy; Sgt. A. H. Martin; Sgt. M. R. Morey; P/O. R. B. Mullinger; P/O. J. D. Pye; Flt. Sgt. T. L. Vinnicombe.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. D. M. Tassie.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—W/O. A. R. Gray.

MISSING.—Flt Sgt. M. G. Barrett-Lennard; F/O. A. N. Buckland; Flt. Sgt. C. S. Cameron; F/O. A. L. Coomes; Flt. Sgt. D. V. Cox; P/O. E. J. Crabtree; Flt. Sgt. A. B. Cummings; Sgt. J. D. T. Daley; Flt. Sgt. H. Ferme; Sgt. N. Fisher; Sgt. J. A. E. Ganley; P/O. A. W. Gunson; F/O. G. A. Hadley; Flt. Sgt. R. H. Hansen; Flt. Sgt. D. Harris; Flt. Sgt. C. G. Hoskin; F/O. A. G. Jennison; Sgt. P. S. Kennedy; Sgt. J. T. Law; Sgt. S. C. E. Leech; Flt. Sgt. A. F. Liebich; P/O. A. Long; Flt. Sgt. O. J. Lumsden; Flt. Sgt. A. H. McDonald; Flt. Sgt. D'A. E. Morrison; Flt. Sgt. R. S. Neighbour; F/O. P. T. O'Farrell; Flt. Sgt. B. A. Plant; Flt. Sgt. A. N. F. Rushton; Flt. Sgt. N. D. K. Swinton; Flt. Sgt. L. E. Waddington; Flt. Sgt. C. D. Ward.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. E. G. Bailey; Flt. Sgt. K. L. Hart; P/O. J. Ledgerwood; F/O. V. F. Lowe; Flt. Sgt. F. J. V. McGrath; Sgt. M. J. Tymms; Flt. Sgt. E. J. S. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. F. Backhouse; F/O. A. K. B. Messer.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. R. F. W. Clark; Flt. Sgt. S. R. Nowlan.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. G. W. Moore.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. A. Cook; W/O. J. L. Gaucher; Sgt. G. R. Wright.

WOUNDED OR INJURED IN ACTION.—F/O. W. G. T. Nixon.

MISSING, BELIEVED KILLED IN ACTION.—F/O. W. C. Ingraham.

MISSING.—Flt. Sgt. J. G. M. Aubin; P/O. C. MacK. Colquhoun; Flt. Sgt. M. C. Craik; Flt. Sgt. W. E. Dickson; Flt. Sgt. F. B. Donnelly; P/O. R. F. Eberle; F/O. E. H. Erickson; Sgt. D. Everest; Flt. Lt. L. R. Farrow; Sgt. H. A. Green; P/O. O. D. Harrison; W/O. A. Heaney; Flt. Sgt. G. McG. King; Sgt W. MacKenna; F/O. H. E. McRae; Sgt. E. G. Miller; Flt. Sgt. N. A. Noble; Flt. Sgt. R. P. Reynolds; Flt. Sgt. N. V. Spencer; Flt. Sgt. D. MacK. Wylie.

KILLED ON ACTIVE SERVICE.—P/O. L. S. Gibson; Flt. Sgt. W. N. Gould; P/O. A. G. Olson; Sgt. L. Sillito.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. G. E. Pridham.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. D. Polglase.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. T. Ray; Act. Flt. Lt. J. M. Smith, D.F.M.

MISSING, BELIEVED KILLED IN ACTION.—P/O. M. O. Jorgensen.

MISSING.—Flt. Sgt. W. D. Webster.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. E. W. McGonigal; Flt. Sgt. D. J. Martin; Flt. Sgt. C. Moncur.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—2/Lt. H. G. Ballard.

KILLED ON ACTIVE SERVICE.—Flt. Lt. R. J. Tait.

Casualty Communiqué No. 319

Of the names in this list, 93 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. A. Dacey; Sgt. A. E. Leslie; Sgt. A. J. W. Lucas; P/O. W. S. Pryce-Williams; Sgt. W. F. Smith; Sgt. G. V. Whitley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION NOW PRESUMED KILLED IN ACTION.—Sgt. E. J. Aspden; Sgt. G. E. Benson; Sgt. H. Bentley; P/O. L. H. R. Binning; P/O. R. Brown; P/O. F. D. Clarke; Sgt. W. H. Clayton; Sgt. R. Davies; Sgt. C. G. Dyer; F/O. J. M. Everill; Sgt. W. H. Gosnell; Sgt. J. R. Gurdon; F/O. S. M. Hobson; Sgt. H. L. Jones; Sgt. J. H. Kimber; Sgt. W. J. McClelland; Sgt. J. Misseldine; F/O. R. C. Morris, D.F.C.; Sgt. H. C. A. Newlands; Sgt. V. Page, Flt. Sgt F. A. Pearson; P/O. R. E. Raven; Sgt. A. C. Sharpe; Sgt. B. M. Singleton; Sgt. T. V. Trollope; Flt. Sgt. J. H. C. Walsh; Sgt. E. S. Wood.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. G. J. Aplin; Flt. Sgt. W. Arnott; Sgt. E. F. Ball; Flt. Lt. L. R. Barr, D.F.C.; Sgt. K. A. Burini; Flt. Sgt. B. Carnell; Sgt. D. J. Clifford; Flt. Sgt. A. Cliff; Sgt. R. F. Clutterbuck; Sgt. R. L. Cole; Sgt. G. W. Dempster; Sgt. R. Dolbear; Sgt. E. L. Eaglen; Flt. Sgt. P. G. Exton; Sgt. L. C. A. Fisk; F/O. K. E. Fraser; Sqn. Ldr. C. F. Gibson, D.F.C.; Sgt. J. D. Haigh; Flt. Sgt. K. R. Hazelwood; Flt. Sgt. A. J. Horwood; Sgt. J. Hoyland; Sgt. B. R. Jennings; F/O. A. D. Johnson; Sgt. L. M. Jones; Sgt. W. E. Jones; Sgt. J. H. Kempton; Sgt. J. W. Kerr; F/O. A. J. Kingham; F/O. A. J. Lane; Sgt. A. Mackenzie; P/O. D. M. Mitchell; Sgt. F. J. Mowles; Sgt. J. Neale; Sgt. P. P. Oakes; Sgt. E. Parker; Sgt. M. S. Pepper; Sgt. S. Poole; Sgt. P. B. P. Price; Flt. Lt. A. F. Prior; Flt. Sgt. J. S. Rigden; Sgt. J. Rutter; Sgt. L. W. J. Schultz; Sgt. H. J. Sharood; Flt. Sgt. J. G. Shepherd; Sgt. G. McC. Sheridan; Flt. Sgt. A. Stokes, D.F.M.; Sgt. K. M. Stuart-Turner; Sgt. C. R. Swift; F/O. R. D. C. Thomas; Sgt. U. Thomas; Sgt. G. W. Trenery; Flt. Sgt. R. M. Urwin; Sgt. N. Vanston; P/O. S. J. Volante, D.F.C.; Sgt. F. J. Walder; P/O. R. J. Wallis; F/O. R. E. Weight; Sgt. J. R. Wells; P/O. R. G. Wright.

WOUNDED OR INJURED IN ACTION.—Sgt. S. W. Farr; Sgt. G. Kelly.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. R. A. Charter.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. A. G. S. Anderson; P/O. S. W. Hatwell; Sgt. T. R. Miller; Sgt. J. L. Radmore; Act. Sqn. Ldr. P. R. Vincent.

MISSING.—Sgt. D. J. E. Adams; Act. Sgt. W. Adamson; P/O. C. T. Anderson; P/O. S. P. Benge; Sgt. W. D. Bickle; Sgt. P. McL. Birt; Sgt. G. J. P. Boyd; Sgt. A. W. Buck; F/O. K. R. Burbeck; Sgt. M. D. Chasmar; Flt. Sgt. A. J. Clark; Sgt. L. F. Collins; Wing Cdr. C. S. Cooper, D.F.C.; Flt. Sgt. I. Cotton; Sgt. E. J.

SERVICE AVIATION

Deaves; Flt. Sgt. F. H. Dennis; Flt. Sgt. J. Docherty; P/O. F. R. Dolling; Act. Sgt. G. F. Edwards; Sgt. E. V. A. Elder; Flt. Sgt. E. Ewan; Sgt. W. A. Finlay; Flt. Sgt. A. V. Forsyth; Sqn. Ldr. K. J. Foster, D.F.C.; Sgt. L. J. Grange; Flt. Sgt. G. J. Green; Act. Flt. Lt. C. A. Hewlett; Flt. Sgt. J. P. Hey; Sgt. C. W. Hodges; Act. Flt. Lt. H. G. Innes; Sgt. M. J. Jones; P/O. J. M. Kirkup; Sgt. H. Lindsay; Flt. Sgt. L. J. Lowndes; Sqn. Ldr. R. A. McKinna, D.F.C.; Sgt. K. G. McLeod; P/O. A. Mair; Sgt. W. B. Marchant; Sgt. R. A. MacT. Mather; Sgt. L. Meadow; F/O. D. M. Nedahl; Flt. Sgt. J. P. Nugent; Flt. Sgt. H. R. Page; Sgt. R. C. Paterson; Act. Flt. Lt. G. E. C. Pease; Sgt. T. J. Pounder; Flt. Sgt. W. A. Robertson; Sgt. J. H. Rodgers; Sgt. J. Stonehouse; Sgt. W. R. Spiers; Flt. Sgt. A. Swinney; Sgt. W. Tebbutt; F/O. P. Thompson; Act. Wing Cdr. F. W. S. Turner, D.F.C.; Sgt. S. A. Walter; Sgt. L. G. H. Weaving; Sgt. B. West; Flt. Sgt. E. A. Worrall.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. J. A. Puttock.

KILLED ON ACTIVE SERVICE.—Sgt. R. H. Bassett; Sgt. J. A. G. Billingham; Sgt. R. E. Butler; Sgt. M. Cohen; Sgt. H. Cox; Sgt. T. W. H. Dalziel; Sgt. R. T. E. Davies; Act. Flt. Lt. V. Duxbury, D.F.C.; Sgt. J. B. Eastman; Sgt. G. C. Edwards; Sgt. W. E. Ellwood; Sgt. E. Farrer; Sgt. L. W. Ferguson; Flt. Sgt. A. J. H. T. Hewat; L.A/C. R. Holden; Sgt. A. Howell; Sgt. O. Hunt; Sgt. D. S. Hunter; Sgt. W. B. Jarvie; W/O. A. H. Johnson; Sgt. J. A. Johnson; Sgt. A. W. Jones; Sgt. L. Lazarus; F/O. J. E. Leveroni; L.A/C. G. G. Marsh; P/O. E. Mearis; P/O. F. P. Moorby; F/O. J. W. Moore; Sgt. D. J. Munro; Sgt. D. R. Pavitte; Sgt. M. R. Pearce; Sgt. R. Pratt; Sgt. D. W. G. Randall; Sgt. J. V. Rees; Sgt. C. H. Romans; Sgt. H. W. F. Russell; Sgt. T. Smith; F/O. J. Suffield; Sgt. L. R. W. Turley; Sgt. R. P. Weston.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. Lambert.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Cpl. S. J. B. Cloke; Sgt. B. Lakin; P/O. B. W. Roughton; Sgt. J. Smith; Sgt. R. Wilson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. R. O. Dyer; F/O. V. L. Hyatt; Sgt. C. T. Lockwood; Sgt. J. McShane; F/O. G. C. Tweedie, D.F.M.; L.A/C. L. C. Softley.

DIED ON ACTIVE SERVICE.—Cpl. J. G. Clark; Cpl. S. R. Colrein; A/C.2 W. H. Dyer; L.A/C. G. H. Fowler; A/C.1 D. Hunter; A/C.1 D. N. Keith; A/C.1 W. F. Magro; L.A/C. D. Meredith; A/C.1 J. O'Brien; Flt. Lt. H. G. H. Phipps; A/C.1 B. N. Parkinson; Sgt. A. J. Sedgwick; A/C.1 E. Short; Cpl. P. W. G. Wilson.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 J. M. Lord.

Royal Australian Air Force

KILLED IN ACTION.—P/O. R. E. Duffy; Flt. Sgt. T. D. Ellis; Flt. Sgt. R. L. Gehrig.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. M. Peake; Sgt. A. R. Roberts.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. J. Lindsay; Flt. Sgt. S. E. Logue; Sgt. G. A. O'Keefe; F/O. K. A. C. Weaving.

WOUNDED OR INJURED IN ACTION.—F/O. L. H. W. Clapson; F/O. E. A. Harris; Sgt. C. Sykes.

MISSING.—Flt. Sgt. J. L. W. Betson; P/O. W. J. Hunt; Flt. Sgt. J. W. Hallas; F/O. A. T. Tuck.

KILLED ON ACTIVE SERVICE.—P/O. R. E. Davies; Sgt. J. M. M. Fraser; Flt. Sgt. J. A. Hazeldene; Flt. Sgt. W. A. Miller; Flt. Sgt. J. W. Woods.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. G. E. J. Craven.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. R. C. Peake.

DIED ON ACTIVE SERVICE.—F/O. F. R. A. Kennedy.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. J. D. Mercer.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. R. S. Braley; Sgt. W. B. Martin.

WOUNDED OR INJURED IN ACTION.—Sgt. M. Stern.

MISSING.—F/O. J. J. Chandler; Sgt. J. G. De Sieyes; Flt. Sgt. J. W. K. Hall; Sgt. H. E. Hansell; F/O. B. S. Jones; Flt. Sgt. J. A. Leach; Flt. Lt. F. C. Lord; P/O. O. Lytle; Flt. Sgt. J. H. T. Monteith; Flt. Sgt. C. E. Morgan; Flt. Sgt. B. M. O'Hara; Flt. Sgt. R. C. Pedlar; P/O. D. J. Sinclair; P/O. R. W. Tully; Sgt. R. N. Wallace.

KILLED ON ACTIVE SERVICE.—Sgt. D. R. Brown; Sgt. C. R. Garrick; P/O. A. C. McKay; Flt. Sgt. A. W. Mullen; Sgt. F. H. Roe; P/O. A. Mck. Ruthven; F/O. S. J. Shewell.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. W. P. Donnelly.

Royal New Zealand Air Force

MISSING.—Flt. Sgt. A. W. Clark; F/O. S. J. Ellis; Sgt. E. C. Hamblyn; Flt. Lt. W. T. Hawkins; P/O. N. Matich, D.F.M.; F/O. R. C. Newcomb; F/O. R. A. Nimmo; Flt. Sgt. H. G. Prins.

KILLED ON ACTIVE SERVICE.—Sgt. K. V. A. Holmes.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—F/O. D. G. Mann.

Air Vice-Marshal C. R. Carr, C.B., C.B.E., D.F.C., A.F.C. (centre), in the H.Q. Operations Room of the Bomber Group which he commands. On his left is his Senior Air Staff Officer, Air Comdre. W. A. D. Brook. The naval liaison officer, on the left, superintends marine mining operations. Air Vice-Marshal Carr held the world's long-distance record for a few hours in 1927 by flying a Hawker Horsley non-stop from Cranwell to the Persian Gulf.

South African Air Force

KILLED IN ACTION.—2/Lt. I. M. Seel.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. R. E. Nissen.

WOUNDED OR INJURED IN ACTION.—Lt. A. C. Paterson.

MISSING, BELIEVED KILLED IN ACTION.—2/Lt. A. G. Turner.

Casualty Communique No. 320

Of the names in this list, 101 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. R. Short; Sgt. R. M. Appleton; Flt. Sgt. A. D. Archer; Sgt. R. G. Bickel; P/O. A. F. Bremner; Flt. Sgt. F. W. Dyde; Sgt. H. R. Ellmer; Sgt. J. H. V. Horsley; F/O. A. W. C. Mitchell; Sgt. H. S. Neeve; P/O. P. N. Rolfe; Flt. Sgt. F. W. Shaw; Sgt. A. E. Smith; Flt. Sgt. R. R. Woodhouse.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. F. H. Delemere; P/O. D. A. Gold; Sgt. D. Kelly; P/O. A. H. Pigge; Flt. Sgt. R. I. Ploskin; Sgt. A. D. Tidmarsh; Sgt. J. Ward; Flt. Sgt. S. L. C. Watts.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. S. Adger; Sgt. J. Allan; Sgt. J. Atkinson; Sgt. J. H. Baker; Sgt. J. R. Barrett; Sgt. W. H. Barrow; Sgt. A. Battram; Sgt. A. Beauchamp; Sgt. D. R. Bishop; P/O. G. A. Bissett; Flt. Sgt. F. A. Budden; F/O. D. N. Cochrane; Sgt. N. B. Collins; Flt. Sgt. P. Comrie; Sgt. D. F. Crowley; Flt. Sgt. R. E. Dorman; F/O. L. J. Dowdall; F/O. J. B. Duncan; Act. Sqn. Ldr. P. C. Elliott, D.F.C.; Sgt. W. H. V. Evans; Sgt. K. C. Eyre; Sgt. L. Farmer; Sgt. S. G. Fisher; Sgt. P. J. Folker; Sgt. B. F. Forman; Sgt. W. G. Gawthorp; Sgt. M. G. Gibbons; Sgt. R. Gill; Sgt. W. J. E. Glenn; Sgt. F. Gotheridge; Sgt. J. S. Greaves; Sgt. L. H. Gregson; Sgt. H. J. Gruntman; Sgt. W. Harding; Sgt. J. Harvey; Sgt. R. F. Hill; Sgt. L. A. Horne; Sgt. S. G. Hunt; Sgt. L. J. Langham; Sgt. R. V. Ledger; Sgt. J. Little; Sgt. J. Little; Sgt. F. McAleese; Flt. Sgt. E. T. H. McClean; P/O. J. A. W. Moffat, D.F.C.; Sgt. F. Morris; Sgt. J. W. Newton; Flt. Sgt. F. R. Oldrieve; Sgt. R. W. Paull; Sgt. R. Pearson; Flt. Sgt. K. G. Peters; Sgt. J. T. Pinkney; Sgt. G. Prigent; Sgt. R. W. Radford; Sgt. D. S. Richings; Sgt. J. G. Ramshaw; Sgt. T. E. Russell; Sgt. J. Ryder; Sgt. W. Shaw; Sgt. W. O. Shelley; Sgt. J. Smurthwaite; F/O. M. J. Steward; Sgt. F. B. Stewart; Sgt. D. Sutherland; Sgt. R. Taylor; Sgt. W. E. Toft; Sgt. R. Unwin; Flt. Sgt. H. Walker; Flt. Sgt. J. P. Warren; Sgt. E. H. Weaver; Sgt. H. J. West; Flt. Sgt. F. A. W. Willis; Sgt. J. L. Whyte; Flt. Sgt. B. H. Yarwood.

WOUNDED OR INJURED IN ACTION.—P/O. L. G. Biddiscombe.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. A. R. Bauga; Sgt. M. O. D. Bennett; Sgt. D. J. Dean; Sgt. J. Dobson; Flt. Sgt. H. E. Hall; Sgt. G. S. Meaking; Sgt. J. L. Morgan; Sgt. W. C. Thomas.

MISSING.—Sgt. R. McK. Alexander; F/O. R. H. M. Bailey; Sgt. W. J. Baker; Sgt. A. M. Barnes; Sgt. G. K. Barnes; F/O. R. Black; Sgt. F. Brierley; Sgt. H. Brown; Sgt. W. N. Burton; Sgt. I. N. F. Cameron; P/O. J. R. Cochrane; Sgt. H. W. F. Cooke; F/O. K. F. Dacre; F/O. E. R. Davies; Sgt. S. B. Didsbury; Sgt. A. R. Downes; Sgt. F. S. Dunn; Sgt. J. M. Emerson; Flt. Sgt. J. K. Gale; P/O. A. M. Garrington; Sgt. C. B. Gazzard; Sgt. T. E. B. Graham; Flt. Sgt. J. A. B. Gray; Flt. Sgt. T. B. Hannan; Flt. Lt. L. H. A. Harper; Sgt. C. Haynes; P/O. S. W. Hickman; Sgt. C. Hopkinson; Sgt. J. Howarth; Flt. Sgt. A. F. Hubball; Sgt. A. L. Jacques; Sgt. D. A. James; Sgt. C. Jeffcock; Sgt. L. C. Jordon; F/O. G. W. L. Keene; Sgt. J. Kelly; Sgt. G. S. Kemp; Sgt. E. J. Lees; F/O. J. V. Linford; Sgt. A. B. McClelland; Act. Sqn. Ldr. A. K. S. McCurdy, D.F.C.; Sgt. C. MacLean; Sgt. H. McMullin; Sgt. R. W. S. McNally; Sgt. W. P. Maher; Sgt. R. Maund; Sgt. S. T. Mills; F/O. G. McK. Milne; Sgt. J. Morris; P/O. R. C. Ord; Sgt. G. Palmer; Flt. Sgt. E. P. H. Peck; Sgt. D. H. Pether; P/O. R. D. Rosser; Sgt. T. Powell; Sgt. J. C. L. Price; Flt. Sgt. A. S. Pring; Sgt. G. Scott; Sgt. F. Shaw; Sgt. N. Sidaway; Sgt. A. H. Simpkin; Sgt. R. J. Smart; P/O. B. C. Smith; F/O. C. Smith; Sgt. W. T. Smith; Sgt. P. G. Straker; Sgt. A. B. Taylor; Sgt. W. Thornhill; Sgt. L. C. A. Walters; Sgt. K. Watts; Sgt. A. R. H. Wells; Sgt. F. Whiteside; Sgt. J. W. Wilkinson; P/O. J. H. Williams; Sgt. R. A. Williams; Sgt. J. Wilson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—A/C.1 A. Parkinson.

KILLED ON ACTIVE SERVICE.—L.A/C. J. Ashurst; P/O. J. R. Brannan; Sgt. T. B. Churn; Sgt. K. T. Creamer; P/O. A. W. F. Foster; Sgt. I. W. George; P/O. L. Gillespie; Sgt. W. R. R. Jenkins; Sgt. F. M. Lay; Sgt. C. G. Morris; Sgt. L. Nichol; Sgt. D. Postlethwaite; A/C.1 S. I. Rosen; L.A/C. R. P. Torbit; Sgt. L. Walkington; L.A/C. L. G. W. Webb.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. L. Bool; A/C.1 K. Drager; L.A/C. J. Graham; Cpl. E. F. J. W. Hoare; A/C.1 K. R. Morse; A/C.1 J. S. Stevenson; L.A/C. W. Thompson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. F. B. Fencott; Sgt. L. D. Lescure; L.A/C. C. R. Owston; P/O. B. A. Wallace.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. S. Carter; Flt. Sgt. E. Fairclough.

DIED ON ACTIVE SERVICE.—A/C.2 J. McL. Armstrong; L.A/C. E. W. V. H. Buckton; Cpl. B. M. Casson; A/C.2 E. H. F. Chalke; A/C.2 D. L. R. Crossley; A/C.2 N. H. Dixon; Flt. Sgt. T. Flannigan; L.A/C. E. J. How; A/C.2 S. A. Humphries; L.A/C. R. J. V. Labrum; L.A/C. H. Maskery; A/C.1 P. Purden; Sgt. A. J. Sharman; Cpl. T. S. Stockbridge; A/C.1 R. Thorpe.

SERVICE AVIATION

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. T. G. Brook; Sgt. J. S. Johnston; F/O. R. Leonard.

Women's Auxiliary Air Force

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/CW. M. A. Sharply.
DIED ON ACTIVE SERVICE.—L.A/CW. J. D. H. Williams.

Royal Australian Air Force

KILLED IN ACTION.—P/O. G. A. Duff; Flt. Sgt. W. Pryde; Flt. Sgt. R. P. Smith.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. M. R. Hehir; Flt. Sgt. A. E. Hiley; Sgt. E. V. Laing; Flt. Sgt. D. C. Morphett; Sgt. H. B. Oliver; Sgt. S. G. Quinlan; Sqn. Ldr. R. J. Watt.
MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. R. H. Adams.
MISSING.—P/O. M. J. Banks; Flt. Sgt. C. K. Bolger; Flt. Sgt. R. Brown; F/O. S. V. Cole; Flt. Sgt. L. M. Dargie; Sgt. W. E. Edmonds; Sgt. G. C. Fowler; F/O. M. E. Garbutt; Flt. Sgt. R. R. Godfrey; Flt. Sgt. G. H. Hughes; Flt. Sgt. B. R. Lambert; P/O. K. A. McIver; Flt. Sgt D. C. Meyer; Flt. Sgt. G. E. Potter; Flt. Sgt. F. Pullom; Flt. Sgt. N. J. M. Veale; Flt. Sgt. G. L. Weller; F/O. J. D. West; F/O. E. O. S. Williams; Sgt. A. W. Wright.
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. W. Miller.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. F. Edwards.
MISSING.—Flt. Sgt. N. L. Reed; Sgt. F. P. Sharpe; P/O. V. A. Stewart; P/O. R. T. Zdan.

Royal New Zealand Air Force

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. I. R. Heays.
MISSING, BELIEVED KILLED IN ACTION.—P/O. R. H. Nelson.
MISSING.—Act. Flt. Lt. J. B. Burnet; P/O. R. Harder; Flt. Sgt. C. A. Harris; Act. Flt. Lt. R. B. Hesselyn, D.F.C., D.F.M.; F/O. J. E. Mortimer; W/O. B. S. Wipiti, D.F.M.

South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—Act. Flt. Sgt. J. J. Coughlan.
MISSING.—2/Lt. R. W. Patsmore.

Indian Air Force

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. G. Q. K. Copinathan.

Casualty Communiqué No. 321

Of the names in this list 100 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

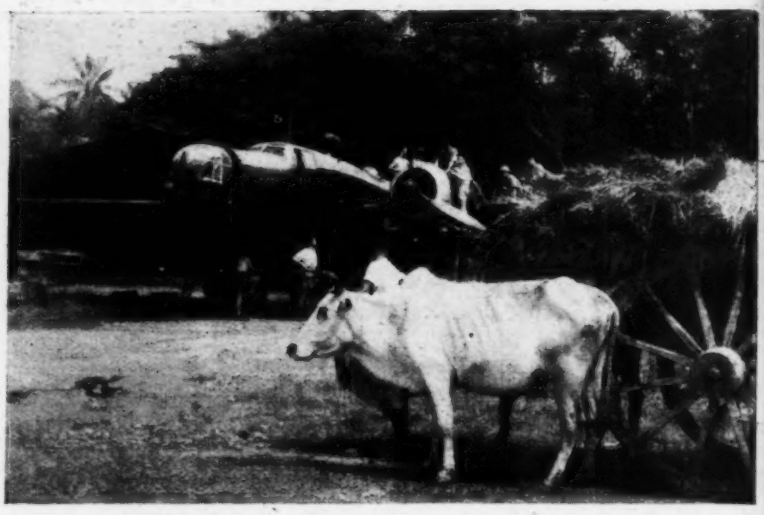
KILLED IN ACTION.—F/O. F. V. Anderson; P/O. C. F. Bale; Sgt. D. R. Booker; Sgt. A. C. Cox; F/O. R. H. Cox; Sgt. F. D. Dickens; Sgt. P. Engel; Sgt. A. Finnemore; P/O. D. N. Green; Sgt. C. H. Hayward; Sgt. G. H. Jackson; F/O. D. McL. Joss; Sgt. W. A. Lineham; Sgt. J. Lowe; Sgt. T. Monaghan; Flt. Sgt. K. G. Mortlock; Sgt. H. J. Payne; Flt. Sgt. F. H. Ray; Sgt. N. P. Winterburn.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. Axtell; Sgt. J. A. Beedim; Sgt. L. W. Bolton; Sgt. M. J. H. Brookes; Sgt. R. A. Halestrap; Sgt. E. D. Harrison; Sgt. D. High; Sgt R. W. E. Holley; Sgt. L. Jakes; Flt. Lt. C. H. S. Kirkus, D.F.C.; Sgt. A. W. McKillop; Sgt. J. I. P. Morgan; Act. Flt. Lt. D. P. Puddephatt; Sgt. D. H. Reid; Sgt. A. I. Stark; P/O. F. M. Thompson; Sgt. G. S. Walton; Flt. Sgt D. H. Williams.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. E. Addison; F/O. J. Baxter; Sgt. G. S. Bowles; Sgt. H. G. Brown; Sgt. R. W. Brown; Sgt. W. Carr; Sgt. J. A. Cross; Sgt. F. W. Davies; P/O. T. E. Emberson; Sgt. P. Evison; F/O. N. D. Fleming; Sgt. G. J. Glare; Sgt. P. F. Hanberger; Sgt. W. B. J. Happold; Sgt. W. A. Hollett; F/O. B. P. M. Hyland; Sgt. J. G. Jewell; F/O. B. Johnson; Sgt. I. B. Jones; Sgt. B. B. Jones; Sgt. B. F. Keable; F/O. W. C. Lambie; Sgt. W. Leven; P/O. W. R. McBriar; Sgt. D. R. McGregor; Sgt. A. S. McLaren; Sgt. B. Moody; Sgt. H. G Mugridge; Sgt. P. T. C. Oldham; Sgt. D. J. Richards; F/O. T. C. Robinson; Sgt. G. A. Rodway; Sgt. G. Rutherford; F/O. R. C. Sawyer; Sgt. G. H. Southam; Sgt. W. A. Summerson; Sgt. L. R. Thompson; Sgt. C. Walker; F/O. E. T. Williams.
WOUNDED OR INJURED IN ACTION.—F/O. J. C. Barrett; F/O. I. D. Smith.
MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. B. Beresford; Flt. Sgt. R. A. Creek; Sgt. F. J. C. Chesson; Act. Group Capt. J. Larwen, D.F.C.; Sgt. H. Munn; Sgt. C. Platt; Flt. Lt. F. E. G. Rashleigh, D.F.C.
MISSING.—Sgt. M. T. Airey; F/O. K. Albiston; P/O. F. N. Alexander, D.F.M.; Sgt. B. C. Anderson; Sgt. E. S. Andrew; Sgt. J. B. Atkinson; Sgt. W. T. Austin; Sgt. C. J. Bailey; Sgt. G. H. Beach; Sgt. R. G. Bentley; F/O. F. W. Bilson; Sgt. M. V. Bloxham; Sgt. W. J. Boyce; Sgt. W. H. Boyes; Sgt. G. H. Brown; Act. Flt. Lt. K. Brown, D.F.M.; F/O. R. S. Bussey; Sgt. G. E. Chapman; Sgt. T. H. W. Cheetham; P/O. K. E. Chislett; Sgt. H. Cleghorn; Sgt. G. E. Cleverly; F/O. J. E. Colyer; Sgt. J. Connolly; Sgt. R. Crofts; Flt. Sgt. J. Curry; Flt. Sgt. V. A. Darkin; Sgt. F. Davies; Sgt. C. C. Davison; Sgt. R. A. Duck; Sgt. A. R. Fare; Cpl. W. P. Fenwick; Sgt. W. Findley; Sgt. D. H. Goldstein; Sgt. D. W. Hadlow; Sgt. G. V. W. Harris; Sgt. W. A. Heal; Sgt. H. J. Henshall; Sgt. E. Hickmott; P/O. R. M. Hogg; Flt. Sgt. A. W. James; Sgt. L. McN. Jeffery; Sgt. H. G. Jones; Sgt. P. F. Kill; Sgt. R. F. Lee; P/O. J. C. Mattey; Flt. Sgt. W. Mell; Sgt. R. E. Morley; Sgt. D. O'Donoghue; Sgt. H. E. Parsons; L.A/C. J. Pass; Sgt. D. B. Polson; F/O. E. D. Porter; Flt. Sgt. W. J. Preece; Sgt. M. Punshon; W/O. W. T. Saunders; Sgt. J. E. Shepherd; L.A/C. G. Smith; Sgt. A. W. Steen; Flt. Sgt. J. T. Sullivan; Sgt. J. S. Thomson; Sgt. E. C. Wadsworth; Sqn. Ldr. W. F. Wallington; F/O. L. S. Webb; Sgt. L. E. P. Wells; Sgt. R. Wilks; Sgt. G. E. Williams; Sgt. C. R. Winterbottom; Sgt. H. J. Wootton; Sgt. C. C. Wren.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Cpl. R. Ainsworth; A/C.1 A. Booth; L.A/C. J. E. Crone; Sgt. J. Hall; A/C.2 J. Marshall; A/C.1 W. Ritchie; A/C.1 N. R. Taylor; L.A/C. T. R. Wicks.
KILLED ON ACTIVE SERVICE.—L.A/C. E. W. Astell; Act. Wing Cdr. A. S. B. Blomfield, D.F.C.; F/O. G. F. H. Booth; Sgt. S. A. Carter; Sgt. H. A. Hay; Flt. Sgt. T. A. Houston; F/O. J. Ingham; Sgt. E. E. Jenner; Sgt. D. V. Joyes; Flt. Sgt. H. C. Marshall; Sgt. S. M. Mather; L.A/C. C. R. Mattless; Flt. Sgt. L. C. Morris; Flt. Sgt. R. F. Neill; Sgt. S. S. Reah; Sgt. J. C. Scammel; P/O. J. I. Simpson, D.F.M.; Cpl. G. R. Stevenson; L.A/C. E. G. Taylor; L.A/C. H. Watson; F/O. R. Westerland.
WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. G. P. Crowe; A/C.2 L. E. Smith.
DIED ON ACTIVE SERVICE.—L.A/C. W. E. Biltcliffe; L.A/C. S. A. Carter; A/C.1 T. A. Edwards; L.A/C. C. S. Eldred; A/C.1 P. T. C. Jones; L.A/C. C. A. Livett; L.A/C. W. McKenzie; L.A/C. F. H. Mahon; Act. Flt. Lt. A. Maurer; F/O. H. S. Newsome; A/C.1 T. O'Connor; L.A/C. R. G. Outlaw; L.A/C. L. V. Raper; A/C.2 C. Ryan; Cpl. H. J. Sharp; A/C.1 E. H. Tate; F/O. B. T. Vardy; Act. Sgt. P. H. V. Weale; A/C.2 B. L. West; Act. Cpl. A. F. Wyatt.
PREVIOUSLY REPORTED PRISONER OF WAR, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. M. J. Hudson.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 R. Reece.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. N. Ferguson; Flt. Sgt. R. H. Flett; Flt. Sgt. J. P. M. Grace; Flt. Sgt. G. S. Sloman; Sgt. S. White; Flt. Sgt. R. G. Younger.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. M. McLay; P/O. P. V. Monk; Sgt. J. H. G. Nash; P/O. A. W. Stubbs.



A truly rural scene at a dispersal point on an Indian airfield.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. G. L. Duffy.
MISSING.—Flt. Sgt. E. J. Ellery; Flt. Lt. P. C. C. Kerr; P/O. W. C. Nelson; Flt. Sgt. J. O. Simpson; Flt. Sgt. D. S. Thomas.
KILLED ON ACTIVE SERVICE.—Flt. Sgt. W. E. Allison; Sgt. F. J. Linden.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. Wrench.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. W. S. Ruxton; Sgt. P. H Sheldon; F/O. S. K. Smith.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. Le R. Bovaird; Sgt. W. H. S. Buckwell; Sgt. J. M. Farrell; P/O. H. E. Forsyth; Sgt. Y. J. B. Guepin; Sgt. A. E. Hurteau; Sgt. A. A. Kew; F/O. W. T. Lane; Sgt. W. A. Lyttle; F/O. L. D. McAllister; Sgt. D. F. McDonald; Flt. Sgt. J. Palmer; Sgt. R. E. L. Ratelle; Sgt. W. A. Simonett; Sgt. R. C. Weedy.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. J. Banks F/O. R. M. Bull; P/O. C. M. Chambers; Sgt. R. O. Fulton; F/O. J. E. Leach.
MISSING.—F/O. J .Allan; Flt. Lt. R. T. Botkin; P/O. C. A. Farnum; Flt. Sgt. J. A. N. Hucker; Flt. Sgt. C. F. McRae; Sgt. R. E. Paddison; Flt. Sgt. W. L. Renner; Sqn. Ldr. M. S. F. Schneider; Flt. Lt. G. Turner.
KILLED ON ACTIVE SERVICE.—P/O. T. P. Quinn.
DIED ON ACTIVE SERVICE.—P/O. J. D. Willan.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. A. H. J. Morgan.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. R. J. D. McGeehan, D.F.M., Flt. Sgt. P. H. Skinner.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. K. Atkinson; Sgt. N. C. Beer; Sgt. R. F. Connor; Flt. Sgt. J. G. Gow; Sgt. I. Griffiths; Flt. Sgt. W. J. MacErlich.
MISSING, BELIEVED KILLED IN ACTION.—F/O. D. M. Adamson; Flt. Sgt. F. S. Edgar; P/O. R. Fuggle; W/O. L. M. Goldsmith; Flt. Sgt. B. P. Higginson; P/O. T. H. Waeres; P/O. R. C. Whitmore.
MISSING.—Flt. Sgt. R. G. Boyd; F/O. B. J. E. Hannah; F/O. A. D. Howlett; Flt. Sgt. N. C. Rollett; Flt. Sgt. H. G. Talbot; F/O. J. G. Taylor.
KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. G. M. McCarthy.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. G. Coben; Air Sgt. J. O. Van Eck.
PREVIOUSLY REPORTED WOUNDED OR INJURED IN ACTION, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Lt. R. H. Lock.
MISSING, BELIEVED KILLED IN ACTION.—Lt. A. E. Cheesman.
MISSING.—Lt. D. Dirver; Lt. I. H. Lawrie; Capt. D. J. Maree.
WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. D. Keyter; Cpl. A. W. Van Blyrk.
DIED ON ACTIVE SERVICE.—Pte. S. Moloi.

Official Correction

Casualty Communiqué No. 309.

Under "MISSING," for Flt. Sgt. E. G. A. Sotheron-Escourt, read Flt. Sgt. E. G. A. Sotheron-Estcourt.